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OFFICE AUTOMATION
CONTENTS

EFFECTS OF OFFICE AUTOMATION ON THE PUBLIC SECTOR WORKFORCE: A CASE STUDY........................Joan Greenbaum
....Cydney Pullman
....Sharon Szymanski

DEVELOPMENT, IMPLEMENTATION, AND IMPACT OF OFFICE AUTOMATION AT THE OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE: A CASE STUDY..William Neufeld

INDIVIDUAL AND ORGANIZATIONAL IMPACT OF COMPUTER-MEDIATED WORK: A CASE STUDY......................Tora Bikson
....Don Mankin
....Cathleen Stasz

OFFICE AUTOMATION IN A MANUFACTURING SETTING..Leslie Schneider
....Robert Howard
....Frank Emspak

OFFICE AUTOMATION IN AN INTERNATIONAL BANKING DEPARTMENT: A CASE STUDY............................Jon Turner

J952-67

Effects of Office Automation on the Public Sector Workforce: A Case Study

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THE IMPACT OF OFFICE AUTOMATION ON THE MUNICIPAL WORKFORCE OF NEW YORK CITY

A Case Study

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THE IMPACT OF OFFICE AUTOMATION ON THE MUNICIPAL WORKFORCE OF NEW YORK CITY

PART I: OVERVIEW AND INTRODUCITON

CHAPTER 1 OVERVIEW
- Primary Themes 1.1
- Principal Findings 1.4
  - Output and Overall Employment Effects 1.4
  - Job Content and Occupational Mix 1.6
  - Work Organization, Job Satisfaction & the Working Environment 1.8
  - Training 1.11
- Policy Recommendations 1.12

CHAPTER 2 INTRODUCTION
- Computer Use Life Cycle 2.2
- Case Study Approach 2.4
  - Methodology 2.5
  - Selection Criteria 2.6

PART II: PRINCIPAL FINDINGS

CHAPTER 3 EMPLOYMENT EFFECTS
- Introduction 3.1
- Increased Output 3.2
- Staff Reduction 3.3
- City Data 3.5
- National Data 3.6

CHAPTER 4 WORK ORGANIZATION, JOB SATISFACTION & THE WORKING ENVIRONMENT
- Introduction 4.1
- Work Organization & Clericals 4.2
- Work Organization & Professionals 4.8
- Recommendations 4.11

CHAPTER 5 JOB CONTENT AND OCCUPATIONAL MIX
- Introduction 5.1
- Clericalization of Professional Work 5.2
- Professionalization of Clerical Work 5.4
- Visible & Invisible Skills 5.4
- Skills & Job Mobility 5.9

CHAPTER 6 TRAINING
- Introduction 6.1
- Training & Clericals 6.2
- Training & Professionals 6.3
- Training & Managers 6.4

PART III: GOVERNMENTAL RECOMMENDATIONS & SUGGESTIONS FOR FUTURE RESEARCH

CHAPTER 7 GOVERNMENTAL POLICY RECOMMENDATIONS 7.1

CHAPTER 8 CONCLUDING REMARKS & SUGGESTIONS FOR FUTURE RESEARCH 8.1

APPENDICES

APPENDIX A: MUNICIPAL AGENCIES: Description, Goals & History;
Organization Charts
Number of Employees
Technology

APPENDIX B: CHARACTERISTICS OF CASE STUDY PARTICIPANTS

APPENDIX C: CUMULATIVE CITY DATA FOR FULL-TIME WORKERS

APPENDIX D: BUREAU OF LABOR STATISTICS DATA: 1982 & 1983

APPENDIX E: JOB DESCRIPTIONS

APPENDIX F: JOB TITLES & MOBILITY

APPENDIX G: UNION STATEMENT ON TECHNOLOGY

APPENDIX H: CHART OF PRINCIPAL FINDINGS

APPENDIX I: RESEARCH TEAM

PART I: OVERVIEW AND INTRODUCTION

OVERVIEW

Office Automation, like any transformation brought about by new technology, evokes a wide-range of responses from workers and managers alike. Management trade magazines paint pictures of the paperless office. Computer hardware and software vendors advertise the inevitability of instant change. The fundamental myth of the technology age--the belief in technology itself--serves to obscure a hard focus on the specific.

The objective of this study, as expressed by the Office of Technology Assessment, is to identify and explore conditions under which office automation has been successfully and productively implemented in New York City municipal offices. We looked at office automation as the hardware and software currently used to foster information-handling. This study focuses on the wordprocessors and microcomputers (also called personal computers) and user networks that are the essence of what is called "office automation".

Using a case study approach we investigatd some of the issues that shape the office automation debate:

- Employment effects;
- Work Organization, Job Satisfaction & the Working Environment;
- Job Content; and
- Training.

This study reports these investigations and points to some specific policy options.

PRIMARY THEMES:

It is commonly assumed that technology itself determines the effectiveness of office automation. We found this not to be the case. Rather, the following factors seem to be primary:

1. **Management stratgies play a fundamental role in determining the effectiveness of office automation use.**

Successful implementation is more dependent on management strategies that involve workers in decisions about job content, work organization and the working environment. In innumerable situations, in which managers find themselves making decisions based on new office automation products, a "gadget psychology" prevails over concerns about how these products may be used in the workplace.

Job Content refers to the tasks and activities that employees do in accomplishing their jobs. Job content always changes with any workplace change and this is particularly true with office automation. But, job content itself depends on job design. In any workplace change, "invisible tasks" may be created: tasks that although not acknowledged, are essential to accomplishing a job.

Work Organization refers to the putting together of tasks -- the way employees and activities are organized. In the infancy of office automation, less than a decade ago, vendors of wordprocessing equipment publicized the pool, or centralized word processing center as an effective form of work organization. Some managers and vendors have since found that decentralized or clustered work organization are more effective.

Our study identifies a variety of work organizations and conditions which enhance office automation effectiveness. We found, for example, that in those situations where work organization is not considered before office automation is introduced, problems arise.

Working Environment refers to the physical layout of the office and the design of office equipment. To employees faced with a new piece of office automation the working environment is the determining factor. Managers and systems designers that do not take account of considerations such as physical layout, ergonomically designed furniture, ventilation and lighting, are missing key elements of effective system implementation. A number of studies have demonstrated the impact of working environment on job satisfaction and productivity, yet, for managers involved in introducing new systems, this information is either unavailable or ignored or lost in the day to day details of installing a new system.

Management strategies are the higher-level decisions involved in interpreting agency goals, as well as the supervisory functions incorporated in day-to-day decision-making. Technical managers, vendors, Commissioners and supervisors make organizational decisions which impact on the way office automation (OA) is used.

Traditionally, implementation of new technology had been considered part of management's package of perrogatives. In municipal government, as in the private sector, technological choice most commonly occurs at management's discretion. Increasingly, however, management literature has begun to emphasize that effective management strategy should include worker invovlement in decision-making. (2) Nowhere is this more evident than in the question of introduction of office equipment for these decisions involve choices that run the gammet from machine preference to forms of work organization.

2.**Agency goals in defining the type of service provided are key in determining the effectiveness of newly introduced office systems.** Agency goals both reflect the type of service delivered to the public as well as affect the ways technology is used to provide those services.

Improved productivity in public sector offices is generally assumed to increase the availability and quality of essential governmental services to the public. Our findings show, that indeed, office automation increases output and therefore can be said to increase productivity per worker, according to the traditional definition of productivity. But this ignores the question of the **quality and type of services** delivered to the public.

We found two basic characteristics about public sector services that parallel definitions of products in the private sphere. These are:

- **assembly-line style** services, or those that can be mass-produced and processed repetitively;
- **custom-designed** services, representing individualized or tailored services that are usually produced with less routine decision-making.

Assembly-line services, like insurance claim-form processing have a longer history of automation and routinization. In the insurance and banking industries for example, mainframe computers have been applied to routine tasks for more than twenty years. A similar pattern exists for routine government processes such as welfare payments and medical dispersements. In these instances, when office automation systems are grafted onto assembly-line style functions, the newer automation tends to resemble the old.

Custom services, on the other hand, have experienced less prior routinization and automation. It is in these areas, like creation of databases for new analytical purposes, that agency goals can play a major part in defining new functions and uses for office automation. (See Appendix A for a description of the agencies in the Case Study).

Agency goals that allowed for some type of "custom" service delivery were generally more successful in increasing output, worker satisfaction and quality of service. Successful implementation, we believe, combines these factors for intermediate through long-term results.

PRINCIPAL FINDINGS

As the themes indicate, the use of office automation is dependent on agency goals and the ways management strategies interpret these goals. Within this dynamic, the issues we focus on concern the effects of office automation on employment, work organization and physical environmnet, job content and skills, and training. These issues are summarized here followed by chapters which specify differences between occupations and agencies.

When looking at the effects of office automation it is always necessary to keep in mind that the introduction of OA is an ongoing process, and one which, therefore, affects and is affected by its environment.

This summary highlights the manifestations of office automation on the office environment:

1. OUTPUT AND OVERALL EMPLOYMENT EFFECTS:

Looking at situations where office automation systems have been in use for about one year we find these patterns:

•Increased output for all job categories with a measurable increase in output per worker in the clerical and paraprofessional fields;

• Management plans for reductions in the number of clerical workers through a process of attrition;

• No short term plans for reductions in professional and managerial jobs due to some creation of new work in this area and an increase in the number of hours worked.

Our case study shows an increase in work output, a perceived increase in the quality of output and under certain circumstances, evidence of the creation of new work. These factors are evident for the four occupational categories we looked at--clericals, paraprofessionals, professionals and managers using OA equipment. We find that office automation did result in the creation of some categories of new work, but primarily brought about a reduction in the necessary workforce in the lower levels of the office hierarchy. This is now particularly acute for clerical workers and may, in some cases, extend into the paraprofessional ranks. Management plans for a reduced workforce are currently being handled through a policy of attrition.

Within New York City government, reduced employment has been a working objective since the fiscal problems of the mid 1970's. Each agency within the city is asked to cost-justify wordprocessor and microcomputer expenditures. City administrators, like their counterparts in private industry, have been able to make a case for increased office automation use by showing the potential that the office automation has to improve the quality of services as well as demonstrating that repetitive data entry and wordprocessing tasks can be done by fewer workers.

We expect that more wide-spread OA use among professionals and managers doing their own wordprocessing will further compound this situation. In the short term (the next 1-2 years) we believe that the arguments for increased clerical productivity will be used to bring about a slow, but steady reduction in the clerical workforce. As is now the case, this will probably be handled through attrition.

Longer term employment effects are less clear-cut. Although increased output is now not considered in quantitative terms for professionals and managers, the argument for greater productivity could be used to cost-justify reductions in the professional and managerial workforce in the future. This option, like the reduction of clerical workers, will be based on particular management strategies. Currently, most managers choosing to use office automation are enthralled with its potential and are busily generating new work for themselves and some of their staff. The short term picture is not likely to focus on staff reductions among professionals and managers.

It's important to note that increased output, including creation of new work, has, in many instances been achieved through **a redefinition of the services performed**. In the clerical and paraprofessional arena this has meant an increase in precoded forms and standardized letters, and in the professional and managerial sphere this had been accompanied by collection of more data and creation of new databases and increased data monitoring functions like reports. Office automation is often viewed as the catalyst that brings these changes about.

When participants in the case study spoke about a perceived increase in the quality of output they were generally referring to the fact that documents that went out of their offices 'looked better', and not necessarily to an increase in the quality of services provided.

Paralelling the rise in output per worker is a noticable increase in the number of hours worked, particularly among professionals and managers. Obviously, this increased productivity, acheived through a lengthening of the working day is not a direct result of office automation, but rather a way of interpreting its use. Near-term management policy on this issue will effect the employment picture for professionals and managers.

Clericals and paraprofessionals also experience greater work intensity, although, generally through union agreement, they do not work beyond normal working hours. This increased intensity, however, has implications for job satisfaction and working conditions.

2. JOB CONTENT AND THE OCCUPATIONAL MIX:

Changes in the occupational mix are occurring as job content--the skills and tasks used to accomplish a job--are changing. The picture is not as yet in clear focus, but the following outlines are discernable:

- Although new tasks are being learned in all occupations, there is little evidence of job upgrading among clerical and paraprofessional positions;

- Contradictory trends show an ongoing clericalization of professional work as well as some professionalization of clerical work;

- Existing job ladders do not reflect a direction of movement for clerical and paraprofessional workers and there are missing rungs in new job ladders--which could have a negative effect on job mobility in the short term;

- Job content includes "invisible skills" such as communcicating and understanding office dynamics. These invisible skills are not being planned for in OA system design; (3)

- Depending on the way office automation is used, abstract-conceptual knowledge can become more important than the traditional definition of skill.

Some studies herald office automation as the tool that brings about an ungrading of skill, while others sound a general deskilling alarm. We find no concrete evidence that either office automation or the job content and work reorganization that go with it, bring about an increase or decrease in skill levels. We do find however, a rather major redefinition in the concept of skill occurring.

One example of the change is the emergence of a contradictory pattern where some clerical jobs are experiencing a form of 'professionalization' as workers get to apply decision-making skills when using computer-based applications, and a corresponding 'clericalization' of some professional jobs as professionals are expected to do their own wordprocessing.

Neither of these trends, however, represent a genuine up or down grading of the jobs in question. Clerical workers who are exposed to new computer applications such as wordprocessing or database programs are indeed acquiring new "skills", but access to these skills is limited by management discretion. In some workplaces clerical workers are taught only the specific steps they will need to accomplish their daily tasks--clearly not a situation that constitutes skill upgrading.

In other situations, where clericals are given broader training and more exposure to new applications, **this increase in "skill" doesn't necessarily imply an increase in pay scales.** The issue of skill upgrading becomes a question of negotiation between the city and the union representatives of the clerical workers. The degree to which a particular groupo of workers weild some clout within an office, coupled with management's plan for job content will determine whether or not skills are increased and whether the increase will have a corresponding effect on wages and mobility.

Professionals and managers who find themselves doing their own wordprocessing often do so to have more control over the material they are producing. Many managers say that while they are spending a growing amount of time doing wordprocessing or database administration these tasks give them a handle on completing a report or gaining a better picture of what they need to do. While an increasing percentage of managerial time may be spent doing clerical activities it would be difficult to label this as an example of downgraded functions. The short term effects of this appear to be negligable, although the longer term ramifications will probably bring about a new division or reorganization of job tasks.

A more serious problem for clerical and paraprofessional workers is that as new computer applications are learned, there are limited job ladders available for climbing out of lower level jobs.

Unfortunately, since the majority of clerical workers are women, this problem exacerbates the dilemnas women already face in low-paying clerical jobs. Women are crowded into the clerical arena. **If the number of clerical jobs declines and job ladders get cut off, women will be facing more crowding and probably worsening pay scales.** This is ironic in the face of the fact that office automation could be used to open avenues to new microcomputer applications. It is interesting to note that although managers who perform wordprocessing are not viewed as experiencing skill downgrading, women who do wordprocessing and other computer applications are not viewed as experiencing skill upgrading.

One of the reasons for this is the fact that "invisible" skills, such as understanding office politics and using diplomacy, are included in definitions and pay scales for professionals and managers. These same invisible skills are not counted in either job definitions or pay rates for clerical workers. Additionally, these same invisible skills, recognized by clerical workers as the keys to getting their work done, are not noticed by systems analysts and therefore rarely included in the design of automated office systems. Clerical workers may, in fact, be performing a wider variety of invisible skills when they try to smooth over problems brought about by poorly designed systems. Yet these skills are not counted in considering them for promotions or raises.

Another problem with the bipolar notion of skill upgrading or deskilling is the fact that it ignores a shift which has taken place in the direction of skill. From clerical workers through managers a change in the definition of skill is taking place. Traditional skills were viewed as concrete specific tasks, such as typing, stenography or computer programming. Office automation heightens the need to view skills as more generic, conceptual categories. Clerical workers, for example, need to visualize a document before they create it—a process which involves abstract concepts and aspects of decision-making. Professionals need to devise a new system for collecting and anlayzing information—again an example of broad-based conceptual knowledge.

Existing job ladders tend to recognize the narrow, more rigid definition of skill creating problems for clerical and paraprofessional workers who get caught at the bottom of the job ladder. Conceptual skills clearly incorporate the notion of invisible skill. For office automation to be used effectively to prevent a stunting of job ladders and to allow for possible skill upgrading, we must recognize that the concept of skill has changed.

3. WORK ORGANIZATION, JOB SATISFACTION, and PHYSICAL ENVIRONMENT

Management theories are clear about the need to carefully plan work organization and physcial environment when introducing new office systems. Most management literature pays attention to the need to plan these factors before systems are installed, and to include workers in the planning process. But management theory and literature don't adequately address the day-to-day problems that arise when new systems are brought in. We found that the degree to which work organization changes occur after installation often confounds managers.

Here are some of the key characteristics we found about the interconnections among work organization, job satisfaction and physical environment:

- Job satisis directly related to work organization and the working environment. The main ingredient of job satisfaction revolves around the degree to which workers have control over decision-making in planning their work;

- When introducing office automation, most managers developed prior plans for adapting work organization and working environment, but most failed to realize the need to maintain an ongoing reorganization process, that involved workers from beginning to end.

- Reorganized work, due to the introduction of OA has brought about increased output, and has also resulted in increased stress levels for all occupational categories;

- In situations where increased output is coupled with isolation and lack of control over work, health problems and increased boredom contradict the gains made in productivity;

- As work is reorganized, shifts in power are occuring with ~~technical~~ and analytical professionals, who have primary access to computer systems, gaining power over traditional departments;

- work reorganization often calls for a new integration of tasks, but many workers at all occupational levels find that the new integration brings about a new form of job fragmentation;

Since the physical or working environment is closely linked with work organization, here are some of the serious health and stress problems that case study participants thought should be highlighted:

- Clerical and paraprofessional workers in our study complained most about physical discomfort, eye strain, and stress--these problems were directly attributable to poorly planned environments and length of time on the equipment;

- There are no clear models for handling lighting, glare and noise problems associated with OA systems;

Job satisfaction is more closely linked with the design of work organization and the working environment than with any aspect of the hardware or software of a system. Repeatedly, participants in our case study reinterated that autonomy, control over planning is primary for them. Office automation fosters job satisfaction to the degree that it enhances these factors.

It is generally assumed that autonomy and control increase as one ascends the job ladder, but planning of working environments for clerical and paraprofessional workers can be used to enhance these aspects of work organization even at the lower levels. In our case study, for example, a group of clerical workers who work in a custom service environment have a high degree of control over their work process and a correspondingly high interest in their work. Since office automation opens the door to work reorganization it can be effectively used as a tool to plan for new forms of work organization that involve clericals and paraprofessionals in the design of their jobs.

All of the agencies in our case study conducted prior work reorganization studies, but the degree to which these plans included lower-level managers, supervisors and affected workers, varied. Once office systems were installed, however some upper-level managers tended to ignore the extent to which informal reorangization was occurring. Office automation does change work organization and these changes, both formal and informal must be recognized and constantly adapted to the new system.

We found that sometimes the lack of ongoing reorganization created problems like lack of supervision and overlapping tasks. In one instance among clericals the workers stepped in and reorganized the work according to what they felt need to be done -- something that could be viewed as a positive step toward job enrichment--although one which could cause further problems if management fails to recognize the effort.

Successful work reorganization needs to include consultation with workers and consideration of the physcial working environment. Clericals and paraprofessionals, in particular, complained about workplace designs that left them physically isolated or created tasks that were to be done in isolation. We found that increased output brought about greater stress in all occupational categories, but this stress was much worse for clerical workers in isolated settings. The excitement accompaning the relatively new introduction of OA masks these potential problems. It is likely that boredom and stress will cause productivity problems in the near future.

Reorganization of work usually brings about power shifts and the introduction of automated office systems is no exception. Professionals and managers with access to database systems and some technical knowledge seemed to feel that they were gaining power within their agencies--probably at the expense of older more traditional departments. This shift-- from traditional department toward newer ones-- will likely continue in the near future. On the other side of the organizational chart, clerical workers with access to wordprocessors clearly have more prestige than other clericals, but this tendency is likely to be shortlived as more and more work is done at automated workstations..

Office automation has been hailed as a way to reintegrate tasks and diminish the fragmentation of work that has been occuring over the last several decades. This potential exists. We saw examples where new work organization called for integrating tasks, such as handling a tax case or a social service problem from beginning to end. But in many situations we found that the formal plan for task integration broke down creating new forms of job fragmentation. This problem, like the others mentioned in this section, could have been avoided had task integration been planned with the involvement of the people doing the tasks and had management acknowledged that ongoing changes were occuring after the automated systems were installed.

Similarly, attention to health and stress issues requires an understanding of the importance of designing and readapting the working environment. This issue has been studied more closely than any aspect of office automation, yet many managers appear to only pay lip service to the problems. Ergonomically designed furniture, indirect lighting and non-glare screens represent a start. But the design of effective working environments must also consider the arrangement of office equipment so as to cut down on printer noise without causing isolation of workers. It needs to take into account indirect lighting without forcing clericals to frequently shift their eyes from dim light to screen light. And it requires work organization that allows for alternating tasks so that clerical workers don't have to spend prolonged periods in front of VDT screens. Many of these design tasks lie in uncharted waters, but ongoing experimentation and adaptation need to be identified as major management priorities.

4. TRAINING

When mainframe computers began to appear in organizations, training was an issue that only involved a small band of technical workers and minimal skill requirements for data entry staff. Now the picture has changed. Office automation systems, particularly wordprocessers, microcomputers and network work stations, are permeating the entire office environment. Not confined to isolated departments, and not limited to specialized functions, these new systems require totally new training patterns.

In our case, the most unifying cry, from clericals through managers, was the call for more and better training. Here are the major elements recommended by our case study participants:

- The needs for transferable training--that is, training that is not specific skill related;

- Equal access to training--with equal opportunity provided for minority women and mature women (between the ages of 40 and 55).

- Extensive and open-ended training--the ongoing opportunity to return to learn new applications;

Lack of access to training along with inadequate job ladders are perceived as the main stumbling blocks to career mobility. Adaquate training is not a panacea for the problems highlighted in the preceeding sections. Rather, to our study participants, it represents a possible path. Most felt that adequate training programs were achievable in the short term, and one agency in our study actually had an operational training program that seemed to satisfy all categories of workers that we interviewed.

The need for broad-based training ties in with the issue of changing skill definition. Broad-based, or conceptually oriented programs can help people learn transferable skills. Programs that focus on only one machine or software package(and these are the types of courses most offered to clerical workers), leave participants with little in the way of new knowledge.

Availability of training is a major problem particularly for minority women and/or mature women who represent the largest category of clerical and paraprofessional workers in the municipal government. Often these workers are given only minimal training on specific equipment and then left to fend for themselves. The myth that mature women are afraid of technology and, therefore not interested in learning new applications, is simply not true. The participants in our study showed a keen interest in ongoing training. To the extent that fear of technology exists, this can be viewed as an across-the-board dilemna for clericals and managers alike. Usually it is not fear, per se, but rather the lack of a supportive environment in which to learn new techniques, that creates apprehension.

POLICY RECOMMENDATIONS

"Improved productivity in public sector offices can increaase the availability and quality of essential services delivered to citizens and make more effective use of public resources...The objvective of this study is to identify and explore conditions under which office automation has been successfully and productively implemented in municipal offices and agencies in a large city."
(from Statement of Work OTA contract No. 433-7990.0)

This case study finds that the use of office automation increased output in all occupational categories under investigation. But increased output doesn't necessarily imply an increase in the availability and quality of services, nor does it mean that increased output will continue after the novelty of office automation use has worn off. In the workshops and interviews we conducted we sought a working definition of effective office automation implementation. From the perspective of participants in this case, effective use goes beyond measurable output, involving job satisfaction factors that influence short and longer term OA use. It also involves an understanding of office dynamics that change as the systems are used.

Our recommendations are presented in two parts: the first illustrates those policies that enhance effect OA use within the workplace and these are listed here. The second outlines proposed recommendations to the government, which are to found in Chapter 7.

WORKPLACE RECOMMENDATIONS:

(1) Full integration of plans for job content, work organization and physical environment prior to office automation implementation and ongoing analysis after systems are installed.

(2) Coordination of office automation implementation plans with active participation of the affected workers.

(3) System design planning that incorporates the hidden or "invisilbe" skills of clericals and paraprofessionals in office systems.

(4) Recognition of invisible skill and abstract knowledge in defining clerical and paraprofessional jobs and in equating these skills with appropriate pay,

(5) Job ladders that recognize the transferability of skills and concepts and foster promotional opportunties for those at the bottom of the office hierarchy.

(6) Ongoing study of the office setting to develop a flexibile, planned environment that would take into consideration--lighting, glare, noise, and the need for non-isolating work space.

(7) Recognition that office automation, when coupled with routine processing, results in a decrease in the clerical workforce; these situations of job loss need to be handled through a policy of attrition combined with viable promotional opportunties, and or retraining options.

(8) Broad-based training programs that reinforce problem-solving skill and abstract knowledge; with access to these programs enhanced through supportive environments for mature and minority women.

For government agencies, and, we believe, private service producing offices, these elements of effective office automation implementation are but a start for facing the problems confronting office workers. Taken together they can begin to foster a coherent office policy that addresses management's interest in productivity gains with employees' search for longer term job satisfaction and security. Office automation is in its infancy. Many of the potential problems still lie buried beneath the issues uncovered here.

INTRODUCTION

Computer vendors are touting office automation as the way to cut spiraling information processing costs. Managers who purchase OA equipment most frequently cite cost cutting and productivity as the primary reasons for their decisions. Yet little is acutally known about the quantifiable aspects of office automation and these arguments sound like a slightly dusted-off version of the same statements heard in the late 1960's and early '70s when mainframe computers were making their much heralded entrance.

Today, the use of office automation is in a similar position to that of mainframe computers in the early 1970's. That is, the bandwagon is parked outside the door, but comparatively few are actually on it. According to general estimates there are approximately 12 million wordprocessers and personal computers in office use now--a small number compared to projected sales of 41 million by 1987. (4) For the most part, office automation equipment has arrived through a trickle-in effect, where a few people in a few departments are using it, often on an experimental basis. We found this to be so in our municipal case study, but it is also the pattern in the private sector as well. (5)

There are several reasons for this trickle-in effect, and all suggest that this period will end shortly--probably within the next year. A primary reason centers around the lack of quantifiable cost-cutting data. Simply put, it isn't clear that the equipment will do what hardware and software producers say it will. Another factor concerns the social adaptability of a system to its environment. When any new system is installed there are bugs and quirks that keep it from its expected tasks, as well as questions about how people using the equipment will react to it. Many managers are waiting to see how these problems iron out in worksites other than their own. And a third prominent reason for the relatively small-scale use of OA is the question of what equipment to buy. An economic change is occuring in the personal computer industry as several large computer manufacturers have gone out of business. For managers about to order their first set of OA, there is always talk of a new product "almost ready for delivery". The economic transformation of the hardware and software industry is almost complete and many of the requested products, like operating systems that support networks, are emerging with more reasonable price tags.

These characteristics are similar to the introduction of mainframe computers, but there are some essential differences. Office automation, generally referred to as computerized equipment to foster information-handling, has primarily developed as a decentralized technology. As a working definition of office automation evolves, the common connotation links OA with wordprocessers, micro or personal computers, and work stations. The basic unit is a decentralized desk-top computing facility which can be connected, through networks, with other units or a central processing unit. The emphasis on decentalized processing is a marked departure from the mainframe days when all files and procedures were handled through a central computing installation. This difference is having, and will continue to have, an effect on work organization and job content, for it means that technical knowledge and control over information need not be kept in only the hands of a few. Office automation has the potential of being adapted to new forms of work organization that allow for decentralized use and control of information.

Another difference from the computer history of the last decade is the fact that office automation is being superimposed on a base of prior computerization and routinization of procedures. The mainframe pioneers had to prioritize, standardize, routinize and otherwise create situations that were ripe for automation.

Most worksites that install OA equipment have some exposure to this early history. This creates both problems and possibilities. The problems evolve because much of the early work was oriented toward centralized control and focused on standard procedures. These programs forced workers and workprocesses to conform to computer-based standards. As noted in the first chapter, OA systems applied directly to these routine and repetitive functions intensify routinization and boredom.

The fact that office automation is coming after the trial and error period of mainframe computer use, means that its introduction and adaptation can occur that much faster. And indeed this seems to be the case, for mainframe computer use took ten years of gestation (roughly the 1960's) before it blossomed. While wide-spread mainframe computer use could not come about until computer software matured, office automation begins with a base of relatively well-tested hardware and a maturing software industry.

COMPUTER USE LIFE CYCLE

Another aspect of computer history, that of the computer use life cycle--or computer use over time, has a direct bearing on the effects of office automation. Social scientists have noted that there are different stages in the adaptation of technology. One model, that seems particularly relevant to the current situation, is a focus on three stages developed through the Center for Working Life in Stockholm, Sweden. (6) Adapted slightly to the American environment, it looks like this:

1st stage--articulation of needs; developing systems

2nd stage--adaption of system to the social environment

3rd stage--problems and inefficiency: downgraded skills

If we adjust these descriptive categories to a discussion of computer use in the United States, we could see that the first stage is the period of hardware and software development. In the mainframe computer period this took about a decade; in the office automation spectrum it occurred over four or five years (beginning in 1978/9, with IBM and Wang's first major entriesin OA) .

The second period, that of adaptation to the social environment is a time of trial and error when technical and organizational problems are uncovered and worked through. In the last wave of computer introduction thic period took most of the decade of the 1970's as systems typically didn't work the "way they were supposed to". The introduction of office automation has again collapsed this time horizon, with adaptation taking place within two years of introduction.

The second stage is particualarly relevant to our study since it is currently occurring and it's outcomes are not yet clear. We found that this second phase has two mini cycles within it:

- The first, which we callthe "honeymoon" phase, is that period when the equipment has just become operational (that is, the technical bugs are no longer serious) and employees using the systems are excited by the novelty of them; and

- The second, or"shakedown" stage, when office procedures are changing to include new forms of work organization and job content.

These miniphases are, of course, overlapping, but the fact that the bulk of our case study participants were in processes between the "honeymoon" and "shakedown" stages has a strong impact on our findings. In fact, we suggest that these factors need to be taken into consideration in other recent studies of office automation.

In the honeymoon stage, increases in output and job satisfaction can be expected since the new way of working at least represents a departure from the routine of the past. During the shakedown stage the outlines of organizational changes become fuzzy as no "one best way" of doing things evolves. It is the decisions about job content and work organization that occur during the shakedown period that, we believe, shape the characteristics of the third phase. Indeed, this process is now taking place.

The model cited above describes a third stage where problems and inefficiencies reemerge, and where downgraded job characteristics become more common. This period occurred in the mainframe computer era during the late 1970's. The problems with centralized control and the technical dilemnas of centralized processing began to give rise to a demand for the type of office automation systems we see today. During this period there was also a corresponding de-skilling of many jobs such as data entry work, computer operations and routine computer programming, as standards and procedures for these types of tasks became well defined.

The characteristics of this third stage in the office automation era are now up for grabs. The extent to which job content and work organization changes result in deskilling and inefficiency will depend on the outcome of current struggles. The trends we highlight in this report are not engraved in stone. We believe that active awareness of these issues by those effected by them, as well as careful policy implementation, can influence the shape of the workforce and the labor process over the next half decade.

CASE STUDY APPROACH

Our case study examined New York City municipal agencies as an example of a government structure that is sufficiently large and complex enough to serve as a microcosm to identify office automation issues in the Federal government as well as other large city and state governments. New York City's annual budget could rank it among the fifteen largest corporations in the United States.

While our objective was to focus on municipal office work as an example of government work processes, it should be noted that we found many similarities between this case and private industry. After the massive restructuring of New York City government following the near bankcruptcy of 1975, the City agencies were reorganized with new management, new work organization plans, redefined job definitions and significantly new missions. Each agency now maintains detailed management plans that outline cost cutting procedures and spell out cost-justified rationals for office automation use. The zeal with which New York City agencies look at the "bottom line" may almost out-do that of some large private corporations. (7) New York City's emphasis on increased output, decreased employment and revenue maximization are active ingredients in its plans for office automation use. For these reasons, we feel that aspects of this case are applicable to the private sector.

The overriding objective of this study, as defined by the Office of Technology Assessment, was to identify and explore the conditions under which office automation has been successfully and productively implemented. Obviously, to do this we had to examine a range of implementation factors. We have evolved a working definition of "successful" or "effective" implementation which includes increased output, and the conditions for continued and enhanced output without reduction in job satisfaction or development of hazardous conditions in the working environment.

Our focus has been on examining:

- Extent of job content change--including such issues as visible and invisible skill, deskilling and/or enhancement of tasks, job satisfaction criteria and time spent on equipment;

- Work organization--looking at issues like reorganization of sections or departments, contact with co-workers, level of supervision, integration or fragmentation of tasks and control over carrying out activities;

- Physical environment--or working environment, focusing on health and stress concerns, and specific workplace conditions such as lighting,ventilation, screen glare and noise levels.

METHODOLOGY

Our approach was to locate a number of disctinct mini-case situations within the muncipal government and then to conduct on-site data gathering workshops. The data gathering workshops, which are described later, were designed to get employee participation, through discussion, around the issues of job content, work organization and physcial environment. In locating the minicase worksites we set up a matrix to identify the following variables:

- Type of office automation--mainframe-based standard data entry, minicomputer network, wordprocessing (centralized and decentralized), and personal computers (desk top);

- Date of system introduction--while most office automation systems were being installed on the heals of other systems we looked for installation of new systems that could reflect the three of stages of the technological life cycle discussed in the last section; (8)

- Agency service type--revenue sharing (funded in part with State and Federal monies, revenue collecting, and revenue enhancement were among the criteria we viewed in selecting agencies whose stated goals were different. Agency service objectives are reflected in management goals and therefore in the use to which technology is put.

As summarized in the first chapter, we felt that the selection of different agencies goals and different types of technology introduced within a varying time frame would help us control for the key variables associated with technology introduction. Our findings indicate that of the three, the definition of agency service type takes precedence over the type of technology. The following illustrates our approach:

TECHNOLOGY LIFE CYCLE------------------→JOB CONTENT

WORK ORGANIZATION

AGENCY SERVICE TYPE←------→MANAGEMENT POLICY←---→PHYSICAL

ENVIRONMENT

OFFICE AUTOMATION

SELECTION CRITERIA:

After locating the target worksites based on agency service type, type of office automation and date of introduction, we identified situations where we could conduct workshops and interviews with employees in the four occupational categories under study: clericals, paraprofessionals, professionals, and managers using microcomputers.

Before beginning the workshops we worked our way down from interviews with appropriate Commissioners and high-level City Directors, through department managers and supervisors. This allowed us to gather background information about management plans and priorities as well as gain acceptance for the goals of the study. We conducted corresponding interviews with union officials and representatives so as to better identify the current issues and the history of work organization changes in the selected agencies. (see Appendix G) The employee workshops and interviews were arranged and approved by city and union officials.

The following matrix represents the locations and occupations of workshop participants:

	AGENCY TYPE		
	REVENUE COLLECTION	REVENUE ENHANCEMENT	REVENUE DISPERSEMENT
ACTIVITY/ TYPE OF TECH. OCCUPATION	wordprocessing/ WP clerical	wordprocessing/ WP clerical	data entry/ minicomputer clerical
	accounting/ PC professional	analysis/ PC professional	case investig./ minicomputer paraprofessional
		management/ PC manager	case investig./ minicomputer professional

Data gathering workshops were conducted for each group with the exception of the managers using personal computers (microcomputers) where it was more appropriate to carry out individual interviews. (9) Participants were selected on the basis of their length of time in the department (priority was given to employees who had been in the agency before the introduction of the new system) and within this criterion volunteers were asked for with the help of union stewards and management-labor committees. Attention was paid to recruiting a balance by sex, age and race, although the occupational groups turned out to be basically homogeneous, following a hierarchy not unlike patterns in other government agencies and private businesses. (see Appendix B)

During the workshops, participants were asked to fill out activity sheet/questionnaires with repsonses to questions in the following areas: background and education; job content; work organization; history of worksite; health and safety; and recommendations.

Discussions were then held to facilitate an interchange of information about each subject area, and participants were asked to add any additional comments to the activity sheets. While the activity sheet data has been tabulated and analyzed, we feel that the real value of the workshop method lies not in its quantitative capailities, but rather as a rich source of anecdotal case material. The comments and responses of the participants, as they exchanged information with each other, often produced unexpected results. For example, we were able to piece together elaborate and informative histories of workplace organizational changes as the participants shared their collective knowledge. These and other illustrations are woven into our findings in the following four chapters.

PART I: NOTES

1. see Diane Werneke, "Microelectronics and Working Women, A Literature Summary", National Academy Press, Washington, 1984, for an excellent summary of recent studies on this issue.

2. see management journals such as the Harvard Business Review for discussions around this topic, see also "Reinventing the American Corporation", New York Times, Business Section, Dec. 23, 1984.

3. the term "invisible skill" is used in Europe to refer to those tasks and abilities which are not seen, yet critical to accomplishing work. It is usually used to encompass such functions as diplomacy, social ability, knowledge of informal procedures and problem-solving. see, for example, Proceedings from the International Federation of Information Processing (IFIP) Conference on Women, Work and Computerization. In particular, see Merete Lie and Bente Rasmussen, "Office Work and Skills", paper presented at this conference.

4. market research firms such as International Data Resources report projected sales frequently in the business press. see for example, "Changing Machines to Suit User Needs", New York Times, Business Section, Jan. 20, 1985.

5. see magazines of the data processing field such as Infosystems and Datamation. In particular see, Lorraine King, "Do OA Vendors Eat their Own Cooking", Datamation, Sept.15, 1984 and see Andrew Friedman, Joan Greenbaum, "Wanted Renaissance People", Datamation, Sept.1, 1984.

6. Arbetslivcentrum, or the Center for the Study of Working Life, is a labor research center in Stockholm. Bosse Jorgansson, presented the stages of technological development at seminars held during 1984 at the Center. Joan Greenbaum, principal investigator of this case study discussed these ideas with him.

7. see Andrew Friedman, Joan Greenbaum and Michael Jacobs, "The Challenge of Users and Unions", Datamation, Sept.15, 1984.

8. We excluded hand-held and portable microcomputers from our definition of office automation equipment. It should be noted that the city procedures for approving expenditures for office automation equipment take from 1-2 years for completion. Thus the OA examples that we were investigating had been ordered and planned for more than a year before they were introduced. Part of this problem is recognized by the City as they attempt to cope with a centralized computer ordering procedure, however the problem is compounded for the Department of Human Services who must request permission through the Federal Government. Current computer requests for the Human Resources Administration have been taking over two years to clear Federal channels.

PART II: PRINCIPAL FINDINGS

EMPLOYMENT EFFECTS

INTRODUCTION

Because office automation is labor saving, there is widespread interest in the question of whether or not office automation is accompanied by a displacement of workers. We found that employment effects including job numbers, increased output, creation of new work, and reorganization, vary considerably by occupational category and type of service agency.

Not unexpectedly, clerical workers are the most severely affected by displacement. Yet, paraprofessionals and professionals, whose contact with the automated processes is often limited, are also affected, though more indirectly.

All workers in the case study, regardless of occupational category indicate that the amount of work they do has increased significantly because of automation. For clericals and some paraprofessionals the increase appears to be linked to either an intensification of work, the reorganization of work, or to the creation of new work. For professionals, the increase in work is either self-generated, an "unintended side effect" of the automated system, or due to the reorganization of work. These last two effects are more significant for those professionals who work in agencies which are "production-oriented".

Increased output can result in a reduction of the workforce, especially for clericals. However, a contradictoy picture emerges when examining national data and projections about clerical workers. Several clerical positions are expected to show significant growth through 1995 as society continues to move into a service and information handling economy. Projections through 1995 are positive though they are beginning to level off. However, when we view those categories of clerical workers which are being particularly affected by automation we see a clear reduction.

In this chapter we will examine the employment effects on various categories of workers that accompany the introduction and use of office automation. The chapter will illustrate our impressions and workers' perceptions. The issues included are:

- All workers perceive an increase in work due to a combination of factors, including:
    - work intensification
    - creation of new work
    - reorganization of work
    - unintended side effects
- Some clerical workers are experiencing a reduction in jobs although national data shows positive projections for this occupational category. Unless alternative work organization and work processes are initiated the reductions could have severe

effects.

- The unions are concerned by the employment effects of office automation whether attributed to attrition, use of non-city employees, or the redefinition of agency goals into cost-effective service delivery which affects clerical workers as well as professionals.

Increased Output

For clericals and most paraprofessionals the increase in output is the result of an "intensification" of work as automated systems are used to incorporate hours of tedious, manual work into precoded forms and standardized letters. For some clericals this has meant the elimination of handwriting or typing hundreds of forms and letters per week. For other clericals and paraprofessionals the automation has reduced the "footwork" associated with hunting for files throughout a work unit which spans several floors. Some files are now called up and controlled on a VDT screen.

Although clerical workers are enthusiastic about being released from the manual processes, many of them now spend almost their entire day in front of VDT screens. Because the new systems have the potential to run continuously and process much larger volumes of error-free work in shorter time periods the clericals feel pressured to work continuously. They are only relieved by down time or breaks—two twenty minute breaks have been negotiated by the union in some offices. However, even where breaks exist, workers take fewer since the office automation was installed.

Centralized Work Unit.

For some clericals the centralization of a work unit represents yet another form of intensified work. For example, a secretarial pool, which replaced the major secretarial services of 30 different work units was formed. According to a manager, this integrated work process gives him more control so that he can set work quotas. "The problem," he says, "is that since supervisors come from the ranks they don't like to confront the workers, but the machine acts like a third party--it can set the standards."

In addition to the increased work generated by the atmosphere of an automated pool environment, the workers in this unit take on an overload of new work due to lack of an adequate supervisory system. The women must spend additional time coordinating and prioritizing the work of the unit. In fact, one women has filed a grievance with her union for being pressured to do out of title supervisory work for which she was not being compensated.

Decentralized Work Unit.

Another type of reorganization (decentralization into clusters) also accounts for clericals reporting an increase in work. However, this is a rather unique case. Because managers were using their own micros to write and edit reports, memos, and other documents, their secretaries' workload was decreased to the point that the secretaries, out of boredom, requested additional work. As a result, managment instituted a Document Creation Center with input from the secretaries.

The purpose of the Center is to handle the extra contracts, reports, merges, print jobs etc. that the regular clerical staff throughout the agency is unable to process. Work from outside the agency is also accepted. So as not to be the source of the elimination of anyone's job, the secretaries in the Center sent a memo stating that the work the Center accepts is to be "extra" work or jobs that are too big for a regular secretarial staff. Three of the secretaries continue to perform regular secretarial duties for their bosses amidst the work of the Center. With the increase in work, the women have the option of working overtime but rarely choose to.

Although this agency may be unique in the number of managers who currently have their own micros, this appears to be a preferred trend for professionals as well as managers. If increasing numbers of professionals and managers continue to perform more of their own clerical tasks the employment effects on clerical workers could be significant unless alternative types of work organization and work process are initiated.

One group of professionals attribute an increase in their work to "unintended side effects" of the automated system. The agency's stated, formal reasons for automating were "to increase the quantity and quality of client investigation." This was to be achieved by removing from the professional's job the client-information-gathering functions that were identified as clerical, standardizing and automating them.

The "new" jobs are performed by entry level workers (office aides) who send out coded forms and control the data. Professionals state that frequently, because of the automated system, superfluous, and often incorrect information is obtained which results in many extra steps for them. This situation--one where more work is being performed, but not necessarily more output--is not uncommon among professionals and managers. In the rush to automate professional functions, one personnel administrator admitted that there were a lot of "failed systems" in this experimental stage of use.

The increased output among professionals and managers tends to be manifested in intensification of work due to a longer work day (we interviewed managers and professionals who were putting in 45 - 60 hour work weeks). The increased output among clericals and paraprofessionals, on the other hand, is due to the intensification of work within a normal work day.

Staff Reduction

In some cases, the increase in output has resulted in a reduction in staff and, there are plans for future reductions. The reductions are most significant for clerical workers whose manually intensive work is interpreted as "redundant" and thus open for automation and increased productivity. City administrators must cost-justify their requests for additional automation in the face of ever-present budget cuts. Thus, a reduction in clerical workers usually is targeted because it is easy to demonstrate that data entry and wordprocessing functions can be performed with fewer workers.[1]

The reduction of administrative staff due to productivity improvements related to microcomputers, wordprocessing and dataprocessing capabilities is documented in the city's, The Financial Plan: Fiscal Years 1984-1988. For the three agencies in our case study, the projections of selective staffing changes due to attrition include:

Human Resources Administration:
- reduction of administrative staff by 4% or 13 positions

Finance Department:
- reduction of 36 staff positions

Department of General Services:
- reduction of 15 clerical positions.

In our discussions with administrators and managers, the reduction of clerical positions was related explicitly to the introduction of automation. One manager stated that the main benefit of automation to his agency has been a 15% reduction in clerical staff. Another manager said that the number of clerical workers will decline 25-50% in her work unit as the system is upgraded. Yet another administrator estimated that the automated system has resulted in a 15-20% reduction in his agency's clerical staff over the last three years. From our discussions with administrators and managers it appears that the city's projections are low and that more reductions in clerical staff are taking place.

One work unit we visited was a pilot project representing 6,100 staff dispersed in forty different locations. The stated goals for the automated system are "to reduce costs, reduce staff, improve efficiency and productivity, and improve the physical environment." Extrapolating from the reductions in clerical and paraprofessional staff at the demonstration site, the projected agency-wide reductions will total 120 workers.

Another large social service project's goals "to increase collections while reducing expenditures" can be verified in increased productivity (1983-$16 million collected; 1984- $27 million collected; 1985- $35 million collected) with a staff reduction from 1200 in 1978 to 850 today. One manager explained, "We are run just like a private business in this respect".

The union expressed concern over the impact this "cost effective" context has on case prioritization in this project. The targeting of cases that have the highest potential for collection also has the potential for reducing the need for the job category of investigator. This job tends to involve more client interaction, hence the impact of this prioritization could result in less effective service delivery to needy people.

Another employment issue expressed by the union involves the use of non-city volunteer or low wage employees, usually for clerical work. These non-city workers include people on public assistance (work fare programs), high school co-op students (working for a designated time period), volunteers (retirees, college students, etc.). Although we have no data to support the extent of such employment, we did observe one work unit which relied on the work of high school co-op students.

This work unit is part of an agency-wide reorganization which involves amalgamating the work of separate smaller work units into an already large unit of over 60 people. The reorganized unit previously had its own managers and support staff. With the use of automation that prompted the reorganization, two clerical workers now perform tasks for numerous professionals. One of the clerical workers spends a great deal of her time working with and training five high school co-op students. She says, "They are trained to do everything I do," including all the work on the micros.

City Data

Examining the "Cumulative Workforce Analysis by EEO Category" for citywide, full time municipal workers from 1979 through 1983 (See Appendix C) we can summarize some general trends:

As a percentage of full time city workers, office and clerical workers declined from 19.7% of the workforce in 1982 to 18.6% in 1983. From 1980 through 1982 their numbers had shown a steady increase.*

It is significant to note that the overall percentage of professionals has declined while paraprofessionals show an increase. We observed instances which point to the "clericalization of professional work" (See Chapter 5 for fuller discussion of this observation), which would suggest an increase in paraprofessional work relative to professional. However, the information we obtained from discussions with administrators and managers suggests that they see the need for more professionals as the potential for new work accompanies the introduction of some forms of automation.

The category that shows the most consistent increase is the supervisory category of "Officials and Administrators", up to 8.9% in 1983 from 4.8% in 1979. The overall workforce total was 116,751 in 1979 and 117,305 in 1983. This means that today every official and administrator is responsible for almost 11 workers, as compared to 1979 when every official and administrator dealt with almost 20 workers. The trend towards more administration and supervision mirrors the private sector where between 1948 and 1979 the number of non-production personnel for every 100 production workers increased steadily from 13.7% to 22.4%. Various economists attribute the rise in supervision, as it represents bureaucratic waste, as one factor in the decline of our economy.2

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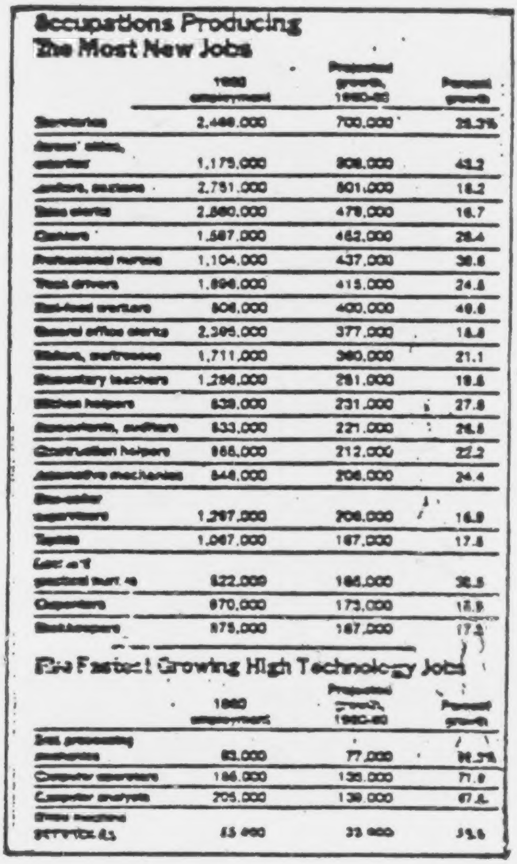
*Figures representing the total number of city workers varies tremendously depending on the agencies included. Our workforce figures are derived from the city's EEO4 report which includes full time workers in those agencies processed through the city's payroll and personnel system, ie. all mayoral and other selected agencies.

An interesting contradiction exists between the possibilities automation has for decreasing human supervision, on the one hand, and the fact that supervision and middle management apprear to be increasing.

In the municipal workforce, over 80% of office and clerical staff are women (with greater than 50% black women). Two thirds of professionals are men (almost half white) with the remaining one-third divided almost equally between black and white women (See Appendix C). Given this gender and race data, reductions in clerical work will take a disproportionate share of jobs from women, particularly minority women.

National Data

National projections based on 1980 data have indicated an increase in such clerical positions as secretaries, cashiers, general office clerks, typists and bookkeepers. (NYT, 9/18/83)



Occupations Producing The Most New Jobs

	1980 employment	Projected growth, 1980-90	Percent growth
Secretaries	2,469,000	700,000	28.3%
Nurses' aides, orderlies	1,175,000	508,000	43.2
Janitors, sextons	2,751,000	501,000	18.2
Sales clerks	2,880,000	479,000	16.7
Cashiers	1,597,000	452,000	28.4
Professional nurses	1,104,000	437,000	39.6
Truck drivers	1,696,000	415,000	24.5
Fast-food workers	806,000	400,000	49.6
General office clerks	2,395,000	377,000	15.8
Waiters, waitresses	1,711,000	360,000	21.1
Elementary teachers	1,286,000	251,000	19.5
Kitchen helpers	830,000	231,000	27.8
Accountants, auditors	833,000	221,000	26.5
Construction helpers	955,000	212,000	22.2
Automotive mechanics	846,000	206,000	24.4
Blue-collar supervisors	1,297,000	206,000	15.9
Typists	1,067,000	187,000	17.5
Licensed practical nurses	522,000	185,000	35.5
Carpenters	970,000	173,000	17.9
Bookkeepers	975,000	167,000	17.2

Five Fastest Growing High Technology Jobs

	1980 employment	Projected growth, 1980-90	Percent growth
Data processing mechanics	83,000	77,000	93.3%
Computer operators	185,000	135,000	71.8
Computer analysts	205,000	139,000	67.8
Office machine services	55,000	33,000	59.6

The Bureau of Labor Statistics report, Employment Projections for 1995, BLS Bulletin 2197, March 1984, shows that clerical workers should expect an increase for 1982-95 ranging between 24% and 29%. This represents a modification of the projections from 1979-95 where the low and high trends ranged between 27% and 33%. The 1982-95 projections can be interpreted as a leveling off of clerical employment attributed, by some economists, to employers' attempts to reduce labor costs and increase productivity primarily through automation (NYT, Summer 1984).

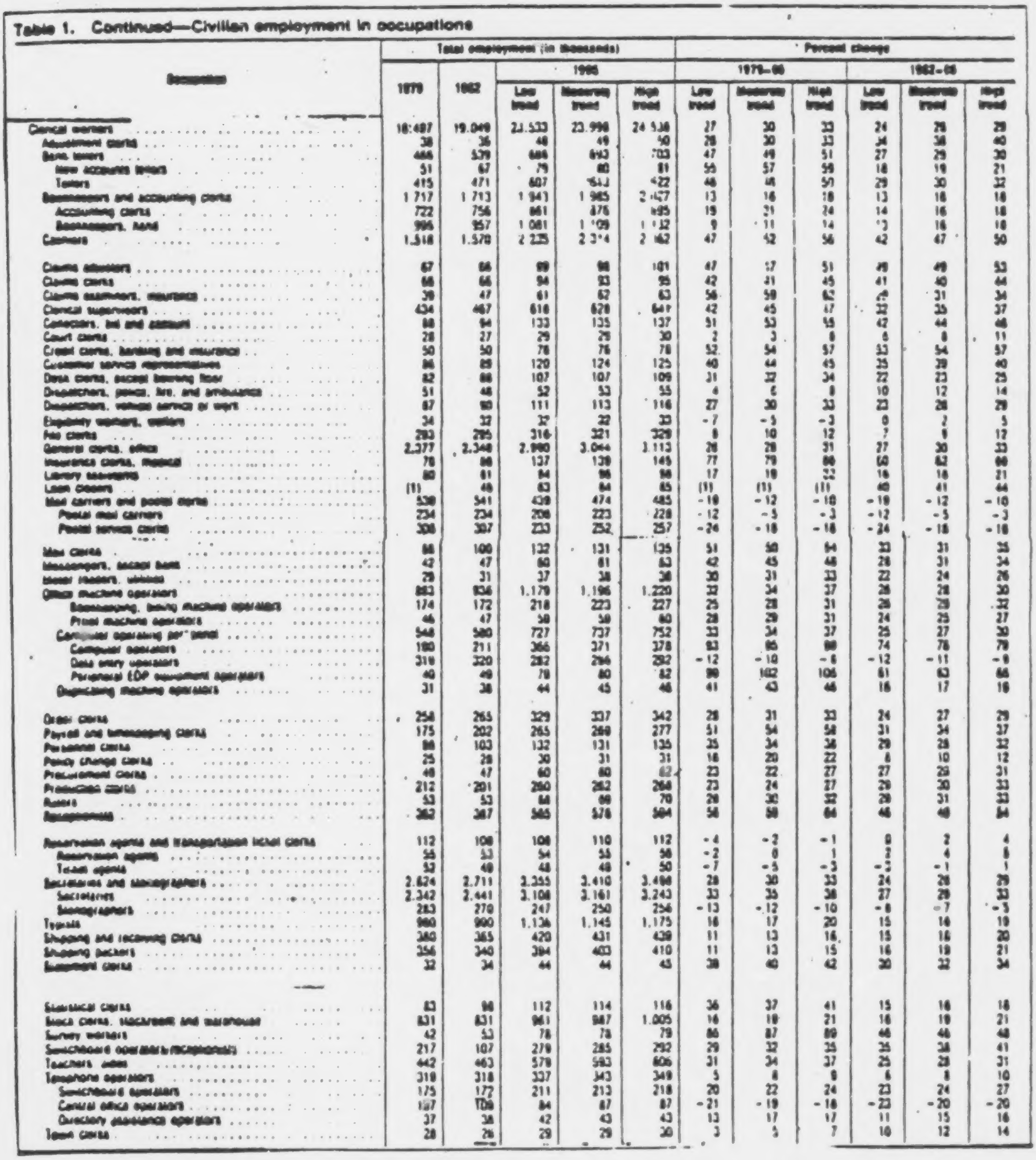


Table 1. Continued—Civilian employment in occupations

Occupation	Total employment (in thousands)					Percent change					
	1979	1982	1995			1979–95			1982–95		
			Low trend	Moderate trend	High trend	Low trend	Moderate trend	High trend	Low trend	Moderate trend	High trend
Clerical workers	18,487	19,049	23,533	23,998	24,538	27	30	33	24	26	29
Adjustment clerks	38	36	48	49	50	26	30	33	34	36	40
Bank tellers	466	539	686	693	703	47	49	51	27	29	30
New accounts tellers	51	67	79	80	81	55	57	59	18	19	21
Tellers	415	471	607	614	622	46	48	50	29	30	32
Bookkeepers and accounting clerks	1,717	1,713	1,941	1,985	2,027	13	16	18	13	16	18
Accounting clerks	722	756	861	876	895	19	21	24	14	16	18
Bookkeepers, hand	996	957	1,081	1,109	1,132	9	11	14	13	16	18
Cashiers	1,518	1,570	2,235	2,314	2,362	47	52	56	42	47	50
Claims adjusters	67	66	99	98	101	47	47	51	49	49	53
Claims clerks	66	66	94	93	95	42	41	45	41	40	44
Claims examiners, insurance	39	47	61	62	63	56	59	62	29	31	34
Clerical supervisors	434	467	616	628	641	42	45	47	32	35	37
Collectors, bill and account	88	94	133	135	137	51	53	55	42	44	46
Court clerks	28	27	29	29	30	2	3	8	6	8	11
Credit clerks, banking and insurance	50	50	76	76	78	52	54	57	53	54	57
Customer service representatives	86	89	120	124	125	40	44	45	35	39	40
Desk clerks, except bowling floor	82	88	107	107	109	31	32	34	22	23	25
Dispatchers, police, fire, and ambulance	51	48	52	53	55	4	6	8	10	12	14
Dispatchers, vehicle service or work	87	90	111	113	116	27	30	33	23	26	29
Eligibility workers, welfare	34	32	32	32	33	-7	-5	-3	0	2	5
File clerks	293	295	316	321	329	8	10	12	7	9	12
General clerks, office	2,377	2,348	2,980	3,044	3,113	25	28	31	27	30	33
Insurance clerks, medical	78	86	137	139	145	77	79	88	60	62	68
Library assistants	80	81	94	96	98	17	19	22	16	18	21
Loan closers	(1)	46	63	64	65	(1)	(1)	(1)	40	41	44
Mail carriers and postal clerks	538	541	439	474	485	-19	-12	-10	-19	-12	-10
Postal mail carriers	234	234	206	223	228	-12	-5	-3	-12	-5	-3
Postal service clerks	308	307	233	252	257	-24	-18	-16	-24	-18	-16
Mail clerks	88	100	132	131	135	51	50	54	33	31	35
Messengers, except bank	42	47	60	61	63	42	45	48	28	31	34
Meter readers, utilities	29	31	37	38	38	30	31	33	22	24	26
Office machine operators	893	936	1,179	1,196	1,220	32	34	37	26	28	30
Bookkeeping, billing machine operators	174	172	218	223	227	25	28	31	26	29	32
Proof machine operators	46	47	58	59	60	28	29	31	24	25	27
Computer operating personnel	548	580	727	737	752	33	34	37	25	27	30
Computer operators	200	211	366	371	378	83	85	88	74	76	79
Data entry operators	319	320	282	286	292	-12	-10	-8	-12	-11	-9
Peripheral EDP equipment operators	40	49	79	80	82	98	102	106	61	63	66
Duplicating machine operators	31	38	44	45	46	41	43	46	16	17	18
Order clerks	258	265	329	337	342	28	31	33	24	27	29
Payroll and timekeeping clerks	175	202	265	269	277	51	54	58	31	34	37
Personnel clerks	98	103	132	131	135	35	34	38	29	28	32
Policy change clerks	25	28	30	31	31	18	20	22	8	10	12
Procurement clerks	49	47	60	60	62	23	22	27	27	28	31
Production clerks	212	201	260	262	268	23	24	27	29	30	33
Raters	53	53	68	69	70	28	30	32	29	31	33
Receptionists	362	387	565	576	594	56	59	64	46	49	54
Reservation agents and transportation ticket clerks	112	108	108	110	112	-4	-2	-1	0	2	4
Reservation agents	55	53	54	55	56	-2	0	1	2	4	6
Ticket agents	52	49	48	48	50	-7	-5	-3	-2	-1	1
Secretaries and stenographers	2,624	2,711	3,355	3,410	3,499	28	30	33	24	26	29
Secretaries	2,342	2,441	3,108	3,161	3,243	33	35	38	27	29	33
Stenographers	283	270	247	250	256	-13	-12	-10	-8	-7	-5
Typists	980	990	1,136	1,145	1,175	16	17	20	15	16	19
Shipping and receiving clerks	380	365	420	431	439	11	13	16	15	18	20
Shipping packers	356	340	394	403	410	11	13	15	16	19	21
Statement clerks	32	34	44	44	45	38	40	42	30	32	34
Statistical clerks	83	98	112	114	116	36	37	41	15	16	18
Stock clerks, stockroom and warehouse	831	831	961	987	1,005	16	19	21	16	19	21
Survey workers	42	53	78	78	79	86	87	89	46	46	48
Switchboard operators/receptionists	217	207	279	285	292	29	32	35	35	38	41
Teachers' aides	442	463	579	593	606	31	34	37	25	28	31
Telephone operators	318	318	337	343	349	5	8	9	6	8	10
Switchboard operators	175	172	211	213	218	20	22	24	23	24	27
Central office operators	107	109	84	87	87	-21	-19	-18	-23	-20	-20
Directory assistance operators	37	38	42	43	43	13	17	17	11	15	16
Title clerks	28	26	29	29	30	3	5	7	10	12	14

The reduction in clerical work we document in this case study is matched by the most recent national BLS data which shows a slight reduction in clerical workers as a whole. However, the BLS data is problematic (See Appendix D).

In 1983 the classifications of many occupations were changed in BLS's reports. For example, the category "clerical" is redefined as "Administrative support, including clerical" and the title, "Cashiers" is moved from the clerical line to the "Salesworker" line. Thus comparison with past data is difficult.

In BLS' 1982 Household Data, the total employment for clerical workers (in thousands) is 18,446 (including 1,683 cashiers). In 1983 the total employment for "Administrative support including clerical" is 16,396. If we add in cashiers (2,009) the total is 18,404. Comparing the 1982 figure of 18,446 with the 1983 figure of 18,446 with the 1983 figure of 18,404 shows a reduction, but not as significant as might be expected. However, if we compare two sub-categories which we know to be highly automated, "Telephone Operators" and "Ticket Agents", (essentially data entry functions), we can observe more clearly the job reducing tendencies of automation when applied to repetitive production type services:

	1982	1983 (in thousands)
Telephone operators	283	244
Ticket agents	154	98

A study by the Georgia Institute of Technology also indicates a reduction in clerical workers in the banking and insurance industries, both of which are highly automated. The study predicts that clerical employment in the insurance industy will be steady from 1980 to 1990, but will decline by the year 2000 to 61% of the 1980 level. The report projects a similar pattern in banking. A slight rise is projected for the 1980's and then a 25% decline from the 1980 figure by the year 2000. Under the study's most conservative assumptions, their projections foresee absolute reductions in clerical employment of 22% in insurance and 10% in banking by the year 2000.

The reduction in clerical employment due to automation, even if we can only show it as gradual now, is of particular concern to women. The exisitng move to automate clerical functions is obvious but it is unclear whether or not women will be able to benefit from the career possibilities that automation brings. By examining the changes in job content, skills and work organization that surround office automation, we hope to point out that workers must be involved in its introduction and use if they are to have clear promotional opportunities. The City of New York has made great strides in recovering from the fiscal crisis of the 1970's. However, a substantial reduction in clerical jobs in both the public and private sectors could precipitate a new crisis for the city if it is called upon to fill in the gap for undertrained and unemployed workers.

WORK ORGANIZATION, JOB SATISFACTION & THE WORKING ENVIRONMENT

INTRODUCTION

The overall response by workers participating in the case study to office technology was generally favorable. However, the definition of "favorable" differs significantly by occupational category.

Clerical workers tend to define their degree of satisfaction in terms of release from tedious manual work. Professionals' favorable rating is related to the amount of information (data bases, data banks) that technology makes available, coupled with its speed, the control it provides over cases, and the potential for new uses. However, these responses refer to the capabilities of the equipment.

We found that the technology, in and of itself, does not determine the effectiveness of office automation use. Rather, in order to evaluate workers' responses, the implementation and use of office automation must be placed within the broader context of the organization and environment of work.

The arrangement of work tasks and duties and how they are combined among workers can either increase or decrease the amount of autonomy, control and variety workers experience. The implementation of office automation tends to be most successful when office automation is viewed as part of a system that includes the organization and environment of work. More specifically, we found that the successful implementation of office automation is related to the degree to which management:

- involves workers in decisions
- allows workers to have more control over the content of their work
- supports diversity in tasks
- designs an appropriate, safe and pleasant work environment.

Management's strategies and motivations are key in determining the impact of office automation on workers. We found that worker involvement by management was limited by whether or not the participation enhanced or at least was not detrimental to agency goals.

On the one hand, we observed that worker participation in the introduction and use of office automation was most limited in those work units in which the services of the agency were previously "rationalized." In these work units, the system design of automation was standardized in keeping with the administration of the agency's goals, i.e. the degree of rationalization of tasks was intensified by the automation. On the other hand, work units in agencies which had the flexibility to offer more "custom-designed" or individualized services experienced greater worker involvement.

The purpose of this chapter is to describe various effects on the organization and environment of work arising from the introduction and use of office automation, and to show how workers are affected by different processes. The chapter focuses on the experiences and concerns of particular occupational groups in differing sevice-delivery systems. Issues and trends that will be highlighted include:

- Reorganization of Work:

  Work is reorganized into 1)pools or centralized units; or 2) decentralized or clustered work units—dependent on management strategies.

- Shifts in Power:

  Some professionals view the potential information that can be available to them through the use of office automation as a gain in power. Professionals who do not use office automation either because they are suspicious or uncomfortable with it may be perceived as losing power.

- Fragmentation of Work:

  Sometimes, in the attempt to streamline services, those functions which are determined to be most automatable are removed and segregated from an integrated work process. These automated functions then often are given to another set of workers to perform. The potential exists for an increase in work, boredom, and dissatisfaction among workers, as the coordination of fragmented tasks grows.

The discussion in this chapter is divided into two parts. The first part describes the clerical experience and the second part describes the experiences of professionals. Although paraprofessionals were an important part of the case study we will not discuss them as a separate category in this chapter. In the situations we observed, the content and experience of paraprofessional work is more similar to clerical as opposed to professional work. What is significant is that in the more service-production work units, the content of professional work was being redesigned to resemble paraprofessional functions.

Part One: Work Organization and Clericals

With the introduction and use of office automation clerical workers tend to experience a(n):

- increase in amount of work
- increase in speed and intensity of work
- creation of new work
- increase in quality of work
- initial enthusiasm about their work due to a perceived increase in skills and promotional opportunities
- increase in physical discomforts.

The extent to which these impact positively on the flow of work and worker satisfaction is dependent on management strategies and motivations in implementing the automation.

Work Satisfaction

In general, clerical workers like the automated system because it alleviates the tedious, repetitive work they performed manually. For example, clericals in one work unit typed between 400-600 letters per week. With automation, these letters are represented by nine forms which are automatically generated by appropriate codes. Another group of clericals had to search for files located throughout their four story building. Now, most files can be called up and examined on the VDT screens.

Prior to automation, clericals working with real property transfer tax manually wrote out the sales history and the fair market value for all property which was to be audited. They complained that: "It would take hours." A log book was kept in which clericals had to enter each case and the various stages of each audit. With automation, the sales history and fair market value of each property is retrieved from the computer and the clerical worker merely attaches this information to each tax return. A tickler file is kept by the computer thereby making the status of each audit immediatly available.

Clerical workers whose jobs involve primarily wordprocessing also express satisfaction with automation. The capabilities of wordprocessing (editing, formatting, spelling corrections) are viewed as "more fun" than their previous manual work and perceived to increase the quality of their work.

All clerical workers attributed their increased interest in work to learning new skills and the possibilities for better jobs. i.e. they like being part of the "high tech" movement and the promises it brings.

The positive satisfaction that all clericals express with the capabilities of the equipment may fall into what we are calling the "honeymoon" phase. The honeymoon phase in the introduction of office automation is the phase in which the "bugs" have been eliminated from the system and everyone is excited about its potential. Whether or not this excitement can be maintained is, for the most part, under management's control. Management can choose to structure the implementation of office automation in ways that impact positively or negatively on worker satisfaction.

Work Dissatisfaction

Since the introduction of office automation most clericals did anticipate and/or were beginning to experience dissatisfaction around a number of issues. Specifically, clericals expressed dissatisfaction with the increased amount of work, routine tasks which make work boring, lack of promotional opportunities, and with such physical problems as eye strain, headaches, backaches and stress and with the poor quality of their work environment.

Centralized Work Organization

In one agency, the installation of office automation was used by management as a catalyst to centralize the work organization for greater control over the workers and the work process. A centralized secretarial pool was established to handle the tax collection forms, billing and correspondence from 30 different work units. This centralization was viewed as a strategic first step in a huge reorganization scheme. As one of the managers responsible for the automated system remarked, "Ninety per cent of everything here was batched typed and handwritten".

The secretarial pool expresses the position of management that, "Information must be centralized for control, and work must have production controls so that management knows what is being done and can push out more work." Prior to automation each of the 30 work units processed its own billing, and correspondence. The centralization process involved removing the typists and support staff in the 30 work units from all but a few higher—level managers who were allowed to keep their secretaries as "perks." Typewriters were then removed so that all correspondence would flow through the central secretarial pool.

Simultaneously, correspondence procedure was standardized to include boiler plate paragraphs. According to one manager, this process "takes the anguish out of letter writing as workers don't need to worry about spelling and grammatical errors." Also, management felt this procedure was necessary due to the low level of skills among clerical workers and the difficulty in getting qualified people into civil service.

The result of this centralized work process, from managements' point of view, is a more integrated work process that can respond to set quotas; increased quality of work which elicits more confidence from the public; and increased tax collections.

In organizing the pool, approximately half of the secretaries were brought in from other work units and were selected on the basis of their excellent typing skills. Most of the secretaries felt they were not given adequate explanation for why they were being moved into a pool situation but they were enthusiastic about learning wordprocessing skills.

When the pool was formed, the secretaries' job titles of Office Aide and Office Associate, were upgraded to Wordprocessor I and II which implies a salary increase.[3] The women who were hired from the "outside," but who had essentially the same job titles received higher salaries, causing friction within the organization. These women had experience using other systems but had to be trained to use the Xerox 860 by the "inside" women. As one "inside" woman expressed it, "I was training people who make $5,000 dollars more than I do."[4] (See Chapter 5 and Appendix F for discussion of job titles, salaries and job mobility).

All the women in this unit (as do most clerical and paraprofessional workers) feel that, regardless of the change in their job title, they are doing more work for which they are not being compensated. This feeling was corroborated by the immediate supervisor who felt that the vast amount of work the unit was producing wasn't recognized. "They (management/personnel) seem to think it's sleepy time down south (here)."

Although there was agreement that more work was being performed, there was mixed response to the nature of the work. In those cases where the secretaries came from work units where they felt their work had been more varied and "interesting" the response was one of boredom with the current work. Most of the women found their work challenging initially but as one women said: "The toy can't cover up for basically boring work." Also, boredom was expressed by women who saw the possibilities the equipment offered for learning new skills but who realized that their chances were thwarted by the nature of their jobs.

However, in general, the women in this unit found their overall work satisfactory. Part of this response can be attributed to an unintended side effect of the reorganization process. Due to the lack of an adequate supervisory system, the women found that they had to work together to coordinate and organize their work. This increased contact among the workers has also extended to training. Because of a lack of resources for training, the women teach each other informally--often after they have learned new skills from reading manuals or by picking up information and tips from temporary workers.

The result of this "unintended side effect" is two-edged--the women indicate a great deal of satisfaction from working as a team and from the feeling that "they run the show," but they are frustrated by the lack of training both for their immediate work and for promotions, and by the additional work they must perform due to lack of supervisory assistance. The supervisor agreed, saying that the equipment itself was "bug free" within one year but that all current problems could be attributed to lack of adequate resources to train staff and no supervisory system.

Decentralized Work Organization

Another example of an "unintended side effect" of reorganization that accompanied the implementation of office automation is formation of clerical "clusters." However, this reorganization occurred under a management style that can be described as informal and participatory, reflecting an agency that is able to provide more custom or individualized services.

In this setting, clerical staff were organized into clusters (maximum of 7 people) with the introduction of office automation. The cluster that was part of our case study performs a variety of word processing and printing tasks for the entire agency as well as for other city agencies. However, the work that the cluster does is "extra work" (special reports, contracts, mailing lists) that the clerical staff of other work units is unable to handle. The services of the cluster were expanded because the secretaries themselves asked for more work when their regular secretarial load was reduced as professionals and managers began to do their own wordprocessing.

As a result of this reorganization the women work as a team, which they enjoy. They feel team work is the key to accomplishing the variety and tremendous amount of work they perform. Although they are each responsible for particular duties, there is considerable crossing of tasks as they help each other out. Despite tight turnaround time, they have considerable control over all facets of their job. They enjoy the diversity of work that comes in from outside the Agency and the occasional benefits that are available (they were invited to the opening of an historical building as the result of the work they did on the pamphlet describing the building's history).

In keeping with management's flexible style in this agency, micros were introduced as a resource and a tool to those who choose to use them. Not only were the recommendations of the secretaries considered when the micros were purchased, but some of the secretaries were included in the selection and shopping. Initially, micros were set up in common work spaces so that those who wanted to use them (secretaries and professionals) could do so without changing their jobs. Secretaries retained their typewriters as long as they chose to.

Eventually, through informal training, curiosity and exchanging of information, the secretaries eagerly embraced word processing and now express considerable interest in acquiring more training. (Training is provided to all employees by an agency-wide training center where courses are not segregated by level of employees. The issue of training is discussed in Chapter 6 of this report).

Management indicated that they were trying to foster a work environment where managers, professionals and secretaries can help each other learn new micro applications at their own pace and apply the tools in ways that they determine to be useful. Staff confirmed this to be so. Management feels that because civil service insures that jobs and people will remain with an Agency this offers room to experiment with using computers for new uses. Management also sees the lines between clericals and managerial workers blending such that a clerical worker isn't "only a clerk" and that managers increasingly will take on more clerical duties.

Working Environment and Health

The physical environment in the decentralized cluster is modern and very comfortable--the office is completely carpeted with coordinated furniture, good lighting and ventilation. Each clerical worker has her own computer work station and computer with appropriately designed desks and chairs. Clericals had few physical health complaints, but did relate eye strain, back pain and headaches to those periods when their work load demands many consecutive hours in front of the VDT screens. Anti-glare screens are used by those who request them.

This is in contrast to the work environment in the centralized word processing pool. This work unit is located in a windowless basement room which has inadequate ventilation and lighting and is poorly maintained. Workers reported feeling nauseous from the lack of circulating air. There are no individual work stations and the twenty-seven workers, spread across two shifts, must share desks and chairs that are ergonomically inappropriate for computer use.

In general, the work environment and the health problems that accompany office automation are of great concern to all clerical workers. Several studies link workers' satisfaction and productivity. to pleasant and safe working environments. One view states that the technology design itself makes the worker more productive. However, this ignores the very important role which workers' participation and attitudes play in workplace efficiency, even within the new automated office.

We found a correspondence between the number of hours clericals spend on the equipment and complaints of eye strain, backache, & fatigue. By definition, workers in wordprocessor titles must spend the major portion of their day using the equipment. However, it is not unusual for wordprocessors or data entry workers to spend their entire day in front of VDT screens.

Similarly, an increase in stress was found among workers who spend most of their day on the equipment. In these cases, stress was linked to the combination of the actual increase in work load and the increase in work intensity due to the unrelenting pace of the machine.

Paraprofessionals overwhelmingly linked the increase in stress they reported experiencing since the introduction of office automation to an increase in workload and to an increase in supervision in the form of more required reports.

In several instances, clericals and paraprofessionals reported that they had experienced or observed an increase in smoking and alcohol and drug consumption. As one women put it, "My Lord, there are more workers on 'medication'!"

The poor quality of working environments contributes to health and morale problems. In most cases, clericals and paraprofessionals report inadequate ventilation, poor lighting, inappropriate furniture (in several cases the furniture consisted of mismatched "left-overs"), excessive noise (frequently clerical's work stations were bunched around a noisy printer). In one case there were complaints of filthy floors which caused dust to get into the disk drives affecting the quality of the work. In describing one work environment a supervisor said, "The conditions here are sweat shop conditions."

In most instances, clerical and paraprofessional workers were not consulted about the introduction of office automation either as it affected the design of the work process or the working areas. In one work unit, the office aides expressed their introduction to office automation as, "We were all intimidated by management". In another work unit, while we were conducting a workshop, furniture and wiring were being adjusted to accomodate a new system. Most of the clericals and paraprofesisonals attending the workshop were unaware that a new system was about to be installed.

Part Two: Work Organization and Professionals

With the introduction and use of office automation professionals tend to experience:

- creation of new work and/or increase in work
- changes in the content of work
- increase in the quality of work

Like clericals, the response of professionals to office automation and their ability to use it effectively, is conditioned by the organization of work and physical environment.

Unlike clerical workers, the use of micros by professionals is ancillary to the overall nature of their jobs. Professionals tend to use micros for inquiry that is immediately job specific, although in some cases where management encourges it, professionals experiment with programming and the creation of new uses. Again, the key to how the automation is used rests with the goals of the agency and management's strategies for organizing the work.

All the professionals in our case study have a positive response to the capacities of the equipment. However, the response to the introduction and use of office automation in general is dependent on the conditions which surround its use. For example, all the professionals say the amount of work they do has increased. However, the response to the increase in work seems to be related to the reorganization of the work process that accompanied the introduction of the automation. In those cases where the work of the professional is viewed in terms of quantifiable services the introduction and determination of the system's use tends not to involve staff. Dissatisfaction is greatest in these cases.

For example, although they were not involved in the decision or the procedures to automate a portion of their jobs, caseworkers looked forward to the automation of the tedious and time consuming task of typing and sending out a variety of forms requesting information on a missing parent. The purpose of the automation was to allow more time to perform investigative work and to gather additional information from other sources. Although more information is available, most of the caseworkers now question the success of the automated system in affecting better services. They cite two major reasons: 1) the system is limited by the quality of the information that is fed into it (an incorrect address or social security number will just get replicated) and 2) the system has generated more and more "small" procedures which not only increase work but also increase the chance for error.

The relationship between points one and two above is summarized by caseworkers in the frustration they experience when they have to spend additional time checking on the "basic" information that is generated by the automated forms system. Prior to automation, caseworkers were responsible for determining what basic information was needed and what forms would be sent out to obtain it. Now, two different clerical positions are responsible for these procedures, the performance and result of which are not routinely reported to the caseworkers. Caseworkers attribute their dissatisfaction with the system to such fragmentation of work coupled with the sense that workers who do not understand what information is important to the whole client process, will tend to make more mistakes.

Tax auditors, another group of professionals, question the effectiveness of the automated system as it effects their work. Prior to automation, the real property transfer tax was a separate unit with a staff of seven. Since automation the unit has been amalgamated into a larger unit of approximately 60 people which is responsible for collecting a variety of city taxes. Although the real property transfer tax is only partially automated, it represents the beginning of a larger reorganization in which all tax auditors in the unit will be trained to work with all of the taxes.

Prior to automation, auditors, in general, handled all aspects of a tax audit--screening returns, correspondence, billing, collection determination. Cases and case follow-up were specific to each auditor. With the introduction of the automated process and the reorganization of the work unit the tax audit procedure has become fragmented and, according to the auditors, more clerical in nature. In general, auditors are now responsible for various parts of different types of taxes (auditors screen batches of taxes at one time; they check other auditor's work; they "punch up" interest calculations). Auditors are being trained to handle the steps that are common to all taxes with only a few designated auditors handling the non-routine and "exceptional" cases.

Auditors acknowledge that the computer itself generates more information quicker and that it provides more control over the status of each case. Yet, they are very dissatisfied with the overall process in which the automation operates. The auditors feel that there is increasingly less need for their professional training and judgement and that their knowledge and suggestions for computer use are not considered.

We will now switch our focus to an example in which the reorganization that accompanied the introduction of office automation is different from that experienced by caseworkers and auditors. This case involves systems analysts who work in an agency which provides more customized services under a management style we characterize as "participatory." The function of the analysts is to improve and enhance the service delivery of the Agency by identifying problems and their causes and suggesting solutions and new policy directions.

Because these analysts are invovled in work processes that are not defined by quantifiable goals their responses to the introduction and use of office automation is very different than the professionals discussed in the previous paragraphs.

Although the introduction and choice of micros was part of overall agency plans, no analyst was required to change his or her job to accomodate the use of automation. However, analysts quickly discovered the many uses the equipment could be put to in order to enhance their jobs. Unlike most other employees participating in the case study, the analysts did not view the use of micros as resulting in an increase in work per se, but rather the micros changed their perceptions about work. In other words, the "increase" is identified as the expansion in the amount, speed and wider range of reliable information that is available. This is interpreted positively because it expands the generation of information which is the core of their jobs--more data provides more options in the analysis of problems.

The analysts cite two outcomes of the increased accesssibility to information. One is a power shift (perceived to be in their favor) and the other is an effect on the content of their jobs.

The power shift is defined in terms of the availability of "objective" data on the various work units they will visit which allows them greater flexibility and control in their examinations. For example, prior to going on location they can work with data and get a head start on the issues; and they no longer have to rely on information generated by managers who may view them as "troublemakers" or "spys."

As the systems generate more data, the analysts have become increasingly more involved in working out solutions in addition to identifying problems. Increasingly, they are requested to provide more technical support. As a result, the analysts feel the need for more familiarity with a variety of systems and software. (Their own training tends to be informal, but they have the opportunity to request one-on-one training from the Local Processing Office.) This "shift" to more technical aspects is viewed as an opportunity to learn more about computer applications, but it also has caused analysts to question the philosophical implications of "technology" as redefining the role of an analyst.

Work Environment and Health

Although these analysts feel that few health and safety problems are associated with their use of office automation, their responses point to what is being recognized among professionals who use micros as "psychological stress."

Professionals and managers who have more of a free hand in experimenting with the use of micros tend to work in an environment which is computer competitive. Although they are not required to use micros there is tremendous self-generated and peer pressure. For example, the basis and acknowledged source of power of the analyst position is information. Thus, analysts perceive their "competitive edge," among themselves as well as among their clients, to be limited only by the amount of time and effort they apply to computer learning and use. As one analyst quipped, "I need to pause occassionally to remember that I'm a human being."

In one case, a deputy commissioner described his view of professional use of micros as one of condoned "creative laziness," i.e., professionals are given the space and support to think of new approaches and uses for computer application. However, he did admit that he saw computer use as an "everyday mandatory tool for management and some professionals," and that while he did pressure his staff to learn and use computers it did not affect their ratings.

Professionals as a group do not report health problems such as eye strain, fatigue, back ache and head aches due to use of automation, although they are aware that when they spend prolonged periods at their micros these symptoms occur. As more and more professionals obtain their own micros these health problems could become significant for a whole new group of workers. The professionals in our case study, for the most part, worked in carefully designed offices with comfortable and appropriately designed furniture. This, coupled with their awareness of health problems helped them adapt their environment to their needs.

Recommendations from Workers

Most clerical workers' recommendations about the issues of work organization and physical environment are grouped around the following issues:

- **Compensation**
  They feel that they have learned new skills that are in part responsible for the increase in productivity. They would like new titles and higher compensation to reflect this.

- **Work Environment**
  They suggest better furniture, safer equipment, more breaks from the machine, better quality work spaces (ventilation, lighting, less noise).

- **Input**
  They want to be included in the reorganizations that are occuring--both in the work process and in the design of the work environment. They feel that fewer mistakes and problems would result with their increased participation.

The recommendations of those paraprofessionals and professionals whose work tends to be highly rationalized mirror the recommendations of clericals. These paraprofessionals and professionals tend to emphasize:

- greater worker involvement in the designing and implementing of automated systems
- the availability of more equipment.

- more diversified work with greater growth potential
- better integration of manual and automated systems.

Professionals who work under less constrained conditions also recommended more equipment. However, their concerns focused more on the wider implications of technology.

JOB CONTENT AND THE OCCUPATIONAL MIX

INTRODUCTION

Job content and the definition of skill is affected by the introduction and use of office automation. The mix of skills demanded within city agencies may change with the introduction of automation. This will vary among agencies, depending on the type of services they deliver and their method of delivery.

We found that the debates around the skill question, posed in terms of whether or not skills increase or decrease with the introduction of office automation, to be inappropriate for our study. Rather, as stated in our "principal findings," our observations and data point to a redefinition in the meaning of skill. Thus, our focus is to draw attention to instances and examples of skill change which, when combined with other research, may point to significant issues and head-off potential problems.

Office automation can be used to combine a variety of diverse tasks into a new job or it can fragment work into many different segregated jobs. Yet the change in jobs and the concomitant change in the required skills may take place gradually or so informally that the occurrence of actual new job content and different skills may go unnoticed. Other factors also may obscure the changing definitions of skill. As discussed in the "Computer Use Life Cycle" section, when automation is first introduced, attention tends to be focused on the technical problems and potentials of the equipment coupled with the excitement over increased productivity. The long range impacts on skill can get lost in the shuffle. Also, traditionally, "skill" as a category for grading clerical and more technical jobs has been used as a quantifiable concept. However, we observed that the skills called into play by the use of office automation tend to be of a more abstract and conceptual nature and, thus, less quantifiable. By custom, these (and other) "invisible skills" tend to be the basis for the job descriptions, evaluations and salaries of only professional workers.

However, academic and popular research is beginning to link the competitive edge of successful corporations to those that acknowledge and include a consideration for "human resources" in defining tasks on all levels and fashioning work environments.[4] In this resPect it is it is interesting to consider the role that office automation may play in bringing to light the "invisible skills" of clerical workers whose jobs are usually characterized as low-skilled and thus low-paid.

Office automation has the potential for providing promotional opportunities. However, unless workers are involved in the introduction and use of office automation in such a way that the changing nature of job content and skills is acknowledged, developed and acted upon, many workers, especially women, will continue to find their skills defined as low level, themselves characterized as superfluous and their promotional possibilities thwarted.

This chapter will attempt to point to the changing nature of skills within the context of job content as it impacts on different occupational levels. The focus of the chapter will be on the following issues and directions we observed:

- The changing nature of skills and job content for clericals, paraprofessionals and professionals, more specifically, the "clericalization of professional work" and the "professionalization of clerical work"

- The effect on "visible and invisible " skills:

  1) The introduction of automation is linked with expectations of increased efficiency and productivity. Hence, automation focuses on those visible skills which appear to be most open to "rationalization."

  2) The introduction of office automation changes the emphasis of job content from traditional notions of "skill" to more conceptual and abstract abilities (invisible skills).

     a. Office automation may provide the opportunity to bring to light the "invisible," and thus uncompensated, skills of non-professionals.

- The type os management strategy used to interpret and carry out agency goals is key in determining to what extent invisible skills are acknowledged.

- A crucial connection exists between how skills are defined and the existence and extent of promotional opportunities. Worker participation in the introduction and use of office automation is essential in determining whether or not changing skills will be recognized, upgraded and compensated.

PART ONE: CLERICALIZATION OF PROFESSIONAL WORK & PROFESSIONALIZATION OF CLERICAL WORK

Clericalization of Professional Work

"Clericalization of professional work," refers to two patterns of work we observed among professionals. On the one hand, we observed managers and professionals using their own micros to perform increasingly more of their own secretarial work--preparation of draft and final copies of reports, memos, charts; retrieval of data from files; sending messages via electronic mail. The result in this instance was the unanticipated reduction of the secretarial workload. If the trend of professionals and managers to perform more of their own wordprocessing continues, as we have every reason to expect it will, serious employment repercussions will exist for an entire occupational segement whose work is being reduced or eliminated.

On the other hand, tax auditors told us that an increasing part of their job was being defined by tasks they termed "clerical." They ascribe the addition of these clerical duties to the introduction of an automated system. Prior to automation, each of seven taxes the city collects was represented by a separate unit. Auditors within each unit were responsible for the billing and correspondence associated with the particular tax. The agency plan is to merge the individual units into one Examinations unit (which now has approximately 60 people) and to have all employees (professional and clerical) trained to handle portions of each tax.

When informed that they would be trained in the procedures of a new tax as the first step in a larger reorganization and automated systems plan, the auditors were enthusiastic about learning a new tax process and the possibilities this afforded in broadening their professional skills. However, since being incorporated into the new system, the auditors contact with the new tax is in the form of such tasks as checking various forms generated by the computer, reviewing other auditor's work for errors and clarity, screening batches of tax returns.

These auditors question the relevance of their particular education and training for tasks that, to them, require no professional judgement. Although the auditors are aware that the automated system is in the beginning stages, and that perhaps the "bugs" have not yet been worked out, they are pessimistic about the removal of clerical functions from the job content of auditor's work This may contribute to the already high turnover rate among auditor. (Auditors generally remain with the city for 1 1/2 years prior to moving into the private sector).

The auditor's experience and dissatisfaction appear to be in direct conflict with management's view that standardizing accounting functions is "upgrading the workforce." As expressed by a manager involved in introducing the system, "If the machine knows as much as the auditor, then the auditor can have more time to review and analyze tax returns."

Although the "clericalization" of the job content of tax auditors has not formally changed either the job descriptions or salary level, the potential does exist for this "downgrading" to occur. Such a possibility is reflected in the history of the change in the job content of caseworkers, usually thought of as the elite among welfare workers. In 1971, the delivery of welfare service was changed in order to separate the delivery of social services from income maintenance.

In keeping with this restructuring, all caseloads and the resulting ongoing contact between caseworker and client were eliminated. As a result, the 10,000 caseworkers in the city were reduced to 4,000. No caseworkers have been hired since 1972 and there have been virtually no promotions. Many caseworkers were reassigned as lower paid "Income Maintenance Specialists" and "Eligibility Specialists". [5]

Professionalization of Clerical Work

A contradictory trend we observed can be described by what we are calling, the "professionalization of clerical work." By this phrase we mean the attempts to automate and clericalize those aspects of professional jobs that are categorized as manually intensive.

For example, in one work unit, a federal audit revealed that caseworkers were performing too many clerical tasks which detracted from the "professional" aspects of their job. The suggestion to remove the clerical aspects and automate them in order to "free up" the professional staff has resulted in a pilot project, "the automated forms project." As a result of the automated system, data entry and wordprocessing personnel now perform those tasks which incorporate the letters and forms caseworkers sent out in order to locate absent, non-support paying parents.

Now, clericals are performing tasks that partially defined the job content of caseworkers. (In the 1970's when casework and caseworkers were essentially eliminated, the clerical lines of welfare work increased, reflecting the changed emphasis to "income maintenance.") And, the job content of caseworker is once again being altered as reflected in the move to change the job title to "Eligibility Specialist". According to caseworkers, the college degree required to become a caseworker is not necessary for the "investigator" job series which also has fewer promotional opportunities.

Many questions are suggested by the trends in the changing nature of job content. Two questions in particular are suggested by the "professionalization of clerical work" and the "clericalization of professional work":

- If the content of clerical work is altered to contain elements of what was formerly termed professional work what does this mean for the skill-content and compensation of clerical positions?
- Similarly, if the content of professional work consists of increasingly more "clerical" functions will the tendency be to "downgrade" professional jobs?

PART TWO: VISIBLE AND INVISIBLE SKILLS

We found, in general, that the content of clerical and paraprofessional jobs tend to be the most altered with the use of office automation while the job content of professional and managerial positions tends to be enhanced.

The tendency for clerical-type functions to be automated can be located in the traditional view of clerical work as a series of routine, highly repetitive tasks. The functions of clerical work can be generalized to include reception, processing mail, filing, typing, making appointments, general office maintenance, filling out and generating forms. These are the visible tasks which are targeted for automation in order to reduce costs and staff, and improve efficiency and productivity.

The traditional management view of clerical work is that highly repetitive visible tasks must eventually be incorporated into machines. In other words, the clerical workers' skills (visible) are embodied in the machine. The result is that as clerical functions become automated , clerical work -- and clerical workers -- are deskilled.

However, it is only when we delve behind the "visible tasks" and listen to what workers are saying about their "invisible skills" that we begin to get a more complete picture of skill itself, as well as the effects of office automation on those skills.

We would like to suggest that the introduction of office automation affects the skill level of workers through at least two different types of interactions. These interactions tend to rely on what we are calling "invisible skills"--those skills and abilities that cannot readily be discerned by an observer but are crucial in the performance of one's job. One interaction consists of the change in skills required by the one-on-one relationship the worker has with the machine. The emphasis here is on more conceptual and abstract abilities. The other interaction consists of the changing skills required to maintain the social relations accompanying a new system.

Although "invisible skills" are present in most jobs at any point in time, we would argue that with the introduction of office automation these skills become even more crucial to the smooth functioning of the labor process. Again, there are two ways in which the introduction of office automation affects these invisible skills:

(1) Increased conceptual & abstract sills are required in the interaction between worker and machine.

(2) Increased "social relations" skills are needed as coworkers interact with eachother and the new system.

Increased Conceptual and Abstract Abilities

With the introduction of office automation, clerical work, and to a great extent, paraprofessional work, requires more conceptual and abstract abilities. More work responsibility, and broader knowledge of the process of the entire work unit or Agency are increasingly important as automated systems are brought in.

Abstractness

The information that is displayed on a VDT screen represents the change over from manual intensive tasks to mental intensive work. Most of the clerical workers we interviewed are responsible for generating a variety of forms based on the information they receive. Each form requires its own series of codes and specific information entered in a particular order. For example, one group of clerical workers is responsible for coding and entering information from the mail into a CRT terminal.

The computer then generates a referral form and maintains a tickler file by due date. When responses are received, the completion or continuation of each case is data entered. This procedure requires knowing a vast number of current codes and numerous outdated codes which must by "updated." The workers who perform these tasks not only know the current codes "by heart" but also the old forms and procedures that correspond to them. The process is also dependent on workers sequential decision making and actions. For example, existing codes may be incorrect or the oder of information may be such that if not changed the piece will be rejected by the computer.

Clerical workers also generate a variety of letters, reports, mailing lists and other such documents using wordprocessing. The screen of a computer does not offer the visual and tangible flexibility as does manipulating paper in a typewriter. Various abstract and decision-making abilities must be called on in order to not only visualize and format documents but also to link together a variety of steps and commands which will generate the work.

Responsibility

With the introduction of automation, supervisor's control increasingly is in the form of examining cumulative computer print-outs. It is assumed that the automated procedures will catch routine, minor errors, i.e., presumably programs are constructed such that the next step cannot be completed until the "correct" information is entered. The machines are programmed to eliminate a series of manual checks. Thus, the information entered by clerical workers instantaneously becomes part of the data base from which other information, conclusions and actions will be generated. Therefore, workers are immediately responsible for the status of the information they enter.

As our observations verified, the importance of these "invisible skill" only becomes apparent when they are not performed well. For example we heard complaints about extra work having to be performed because workers entered incorrect data in the beginning stages of a process.

Knowledge of the Whole

As implied in the previous paragraph, the usefulness of information and data bases are measured by the the quality of their input. In this case study, most data entry functions are the basis for further professional decisions. Some professionals complained about having to perform extra work to correct the work of clericals. Professionals attributed this to clericals not knowing how their jobs related to the whole scheme of the work unit. It was felt that, for example, if the importance of an accurate social security number was understood as the basis for all future incuiry, workers would be more interested and careful in securing the correct numbers.[6]

We believe that it is not necessarily the neglect of the worker that is at fault, but rather poor design and or inadequate training that results in error.

One group of workers in a wordprocessing pool said that because they are doing so much varied work from all over their agency, that they are required to know more about the whole operation.

Social Relations Skills

In this case study, we have found that as clerical work is aggregated into pools or clusters with the introduction of automation, more contact with personnel outside the pool/cluster results. For example, the secretarial pool is responsible for all billing, correspondence and memos generated by 30 different work units. The secretarial cluster accepts large wordprocessing tasks and mailing list compilation requests from inside its own agency as well as from other agencies.

As a result of the numerous and varied "users" of the pool and cluster, clerical workers frequently must contact the user (usually a professional from outside their work unit) who submitted work in order to clarify the job. Such clarification relies on the abilities of the clerical workers to interpret the submitted work as it relates to a variety of computerized forms and options, and to determine what additional information is necessary. Clerical workers feel that their diplomatic skills are key in dealing with personnel who submit work that is indecipherable, incorrect, or late.

Either because of lack of adequate supervision or because of particular management strategy, the clericals in both pools and clusters spend a significant portion of their work time organizing their own work process. Such interdependence calls on the abilities of workers to create congenial working environments; to prioritize not only their own work but that of their working group; and to solve problems using their own resources.

Paraprofessionals also must call on "invisible skills" to smooth over unanticipated problems resulting from an automated system. (We are not implying that invisible skills were not crucial prior to office automation, but that the successful functioning of new systems is highlighting the importance of these skills).

In one work unit, paraprofessional contact (either in person or by phone) increases significantly when incorrect information is generated by automated forms. In these instances, paraprofessionals feel they need extra amounts of patience and diplomatic skills and must be able to respond quickly and accurately to numerous and varied requests. The invisible skills they indicated as particularly important include: a good memory for information on different clients; a knowledge of what services other agencies provide which may be useful to their clients; and "street smarts" in sizing up clients.

Workers' View

All workers who participated in the case study consider their invisible skills most important for doing their jobs. Most workers feel that these skills are not recognized and therefore remain uncompensated.

The highest degree of job satisfaction is expressed by those professionals whose invisible skills most nearly match their visible tasks. These professionals work in environments where their invisible skills are acknowledged--both in job description and in salary.

In those cases where professional and paraprofessional work is circumscribed by mandates of mass-production type delivery of services worker satisfaction is low. In these situations invisible skills are virtually ignored. Rather, the focus is on how visible skills can be incorporated into a production type process in order to compliement the quantifiable goals of the agency.

The least satisfaction is expressed by clericals who spend most of their day on computers. This is in contrast to clericals (even those in pools and clusters) whose days consist of some data entry, wordprocessing, mail processing, making appointments and other varied tasks. Clericals in these situations have more contact with co-workers (more use of social skills); they have to rely on their organizational skills as their responsibility for coordinating more tasks and people increases; and they feel more in control over their time.

In general, we have observed a correlation between job satisfaction and the use and recognition of invisible skills. (See Appendix E for a sample of job descriptions)

Management Strategy

The type of management strategy used to interpret and carry out agency goals is key in determining to what extent invisible skills are acknowledged.

In this sense, management strategy has bearing on the "skills question." As discussed in the first section of this reprot, just like any information handling industry (public or private), the services the city provides can be categorized broadly into:

1) mass produced information handling: work is organized in a more-or-less assembly line fashion with a top-down style of management,

2) customized, or individualized-services, information handling: work invloves more participation by employees and more actual services are delivered to the client.

If the services, as defined by Agency goals, are fairly standardized and tending toward quantifiable goals, then the visible skills of workers will be stressed relative to invisible skills. In other words, to the degree that management attempts to make a service-delivery process "production," the emphasis will be on worker's visible skills.

For example, we observed instances where the invisible skills of professionals were recognized as defining the service-delivery of the work unit. As the work units moved toward defining their purposes in more "production" terms two types of scenarios were observed. In one case, the content of the service-delivery is in the process of being redefined such that the work will be done by paraprofessionals in a more automated context. In the other case, the content of the professional jobs is being altered to include more tasks of a clerical nature. In both cases the move is to more emphasis on visible skills. In both cases there is a great deal of worker dissatisfaction.

Skills and Job Mobility

All clerical workers perceive their interactions with office automation as an increase in skills for which they are not adequately compensated. Clerical workers express dissatisfaction over a changing job content--increased work and better quality work--which is not matched by increases in pay or promotional opportunities. Some professionals, recounting the history of the degradation in social services which eliminated social workers and caseworkers, worry that computers offer the potential for clerical workers to take over professional functions.

Managers, on the other hand, represent a position which is often in contrast to workers. In an attempt to increase the efficiency and production of their services, some managers feel that as many clerical procedures as possible must be standardized and automated as a method of cutting costs. There are also managers who see no reason to focus on developing wordprocessing skills, much less job ladders, because they believe wordprocessing will not be a long term trend--"It will be knocked out of the ballpark in 5 years (as managers increasingly learn to use micros.)

We must also consider the fact that the use of micros in the city is in the over lapping phases of what we are calling the "honeymoon and shake-down" period in the life cycle of computer installation. This overlapping period, characterized by many changes and responses which occur rapidly, reflects the unclear policies and defensive positions the city and union express over office automation.

Job mobility for clerical workers was dramatically changed in the 1970's when broadbanding eliminated steps in the clerical career ladder by collapsing some job titles and eliminating others. (Refer to Appendix F for the discussion on the following two pages).

The clerical titles represented in this case study include, office aide (OA), office associate (OAssc), principal administrative assistant (PAA), technical support aide (TSA), and wordprocessor (WP). The range of salaries for these positions are:

Office Aide	$12,591	to	$18,177
Office Associate	15,543	to	20,511
Principle Adm. Assoc.	20,111	to	33,082
Technical Support Aide	13,016	to	21,895

The lines of promotion for these jobs are:

Office Aide ⟶ Office Associate ⟶ PAA

TSA ⟶ 1A ⟶ 1B ⟶ 2 ⟶ 3 ⟶ Computer Associate
(Data Entry)

note: progression from TSA2 to Computer Associate is not automatic but by examination. Progression from TSA2 to TSA3 is by assignment. Automatic maturation to level 2 is in dispute between the union and the city.

WP ⟶ I ⟶ II ⟶ III ⟶ Associate ⟶ PAA
(6 months) (1 year)

note: Associate Word Processor is a supervisory title which includes performing highly skilled applications

Because the city is in the process of adapting to office automation, these job titles and job lines are in flux. Ten years ago, with the introduction and need for many data entry workers, the union negotiated over the data entry job title of "Technical Support Aide" with a corresponding salary increase. From one perspective the negotiations were successful in that the new skills of data entry were recognized in a salary line greater than the "former" clerical title of Office Aide. This move benefitted and continues to benefit a great number of workers. For a variety of reasons, many office aides did not get reclassified to TSA although they do data entry work. However, although both TSA's and OA's perform data entry functions their lines of mobility are significantly different.

Office Aides begin at $12,591 but theoretically have the opportunity to progress into the PAA line which has a minimum salary of $20,111. TSA's begin at a slightly higher salary of $13,016 (the mean salary for TSA's is also higher by approximately $2,000) and, once again, theoretically have the possibility of attaining the maximum salary of $23,331. Their promotional title, by examination, is to Computer Associate (Technical Support), but almost no TAs pass the exam. One union official linked the difficulties workers experience in testing to the fact that they are not really hooked into a computer setting and lack adequate training resources.*

These problematic job titles are further complicated by what appears to be inappropriately designed testing procedures. For example, in 1982 when the last open competitive exam was given for OA's to become TSA's few inside workers passed, although the OA's were already performing data entry functions. The issue continues to be "worked through" by the city and the union. While the union's focus is on providing resources for on-the-job training the city prefers no staff turnover and limited promotions.

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*In this sense, the TSA line could be characterized as "dead end" as opposed to the office aide line where workers have the potential of becoming PAAs.

In 1984 the title of word processor technically came into existence through negotiations. According to one union official, "It took two years to get the word processor title. They (the city) brought in word processors without the union's knowledge." This official explained that the city had violated the contract which stated that new negotiations must occur when new equipment is brought in.

As in the TSA job line, the word processor line has some hidden costs. In order to be classified as a wordprocessor, "wordprocessing activity must be the employee's primary responsibility ..." As more studies and research are discovering, significant health and stress effects are associated with prolonged screen work.

One union official explained that the current union concerns--job security and mobility, deskilling, pay, working conditions, training, boredom and stress--have always been union issues, but that they are brought to a new level with office automation. (See Appendix G)

Chapter 3 Footnotes

1. Several administrators felt that their hands were tied when requesting more computer equipment. The process of writing requests for equipment, obtaining approval—sometimes both at the level of the city and the state—and receiving the equipment can take anywhere from 1-3 years. Although they feel that computers would be very beneficial in service enhancement for a variety of "non-quantifiable" reasons, the administrators know that at this time requests based on "quality" arguments have very little weight.

2. Bowles, Gordon, and Weisskopf, Beyond the Waste Land, Anchor Press, 1983. The supervisory figures are on p.130.

Chapter 4 Footnotes

3. The maximum salary for Wordprocessor is higher, but the mean salary is not necessarily higher than Office Associate. There is a great deal of dissatisfaction with the promotional possibilities in the "technical" lines as represented by the job titles of Wordprocessor and Technical Support Aide.

Chapter 5 Footnotes

4. New York Times, 12/23/84, Business Section, "Reinventing the American Corporation.

5. "Welfare Workers In Perspective: An Anatomy of a Welfare Center in the South Bronx," by John T. Doherty, Senior Seminar in Foreign Policy, Department of State, 1977, pp. 22-26.)

6. New York Times, 9/30/84.

TRAINING

Introduction

While training can not be a panacea, it is, at the moment, part of the problem. Clearly office automation creates the need for a new set of training criteria for job entry and career mobility. Furthermore it has a known track record in fostering job satisfaction and enhancing productivity. Unlike some of the issues discussed in the preceeding chapters, the paramaters and pay-offs of training programs are fairly easy to define and implement. Here are the highlights we found that characterize more successful training:

- The use of both formal and informal courses, where informal training follows prepared courses to reinforce the material in the actual working environment.

- The need for a supportive environment for both types of training, including instruction by trainers 'from the ranks' rather than professional instructors.

- Transferable application training, beginning with specific applications, such as word processing, but emphasizing the concepts rather than specific codes or 'button pushing'.

- Ongoing access to courses so that knowledge can be built up as needed.

Other studies fill out this picture in more detail, specifying the content and learning process used in existing programs. (7) Some of these characterisitcs include:

Courses that include computer literacy vocabulary to give managers as well as clericals a better handle on the language of the field. Scandinavian training models have shown that this is an essential first step in creating an environment where those affected by the technology can participate in decisions about its use.

A course that includes a 'hands-on' introduction to different computer applications such as database, wordprocessing, spreedsheets, and where appropriate graphics. This type of exposure helps employees perceive a fuller range of computer capabilities and may help them identify areas where these applications could be used on their worksite.

A first course in only one application, ususally beginning with wordprocessing or operating system commands. Additional courses to be given when appropriate.

Informal on-site technical reinforcement through visiting trainers and, if possible the availabily of a computer resource center or 'hot-line'. Clearly and appropriately written procedure manuals are an essential part of this package.

Purpose of Chapter

This chapter illusrates the impressions and suggestions of the case study participants about their specific training needs. The information is presented by occupational category. Since the paraprofessionals in this case study were not dependent on office automation their training requests were minimal and played a back-seat role to their need for simply less work or more workers to do the tasks at hand. This chapter focuses on the issues raised by clericals, professionals and managers.

CLERICALS

The clerical workers in the case who primarily performed data entry functions were frustrated by their lack of information about the system they were using. They had been given only a few days training in entering specific codes into the system. They had not been told in advance about the system or given any preparation for the training. As one participant said to the others "Come on now, admit it, you were scared crazy when the system came in". The others nodded in agreement.

These data entry workers had a low level of motivation about their jobs. They called the data entry terminals 'wordprocessors', and now referred to themselves as wordprocessing operators--obviously showing the need for the increased self-image and respect that wordprocessing connoted to them. However, they had received no wordprocessing training and there were no plans to offer them any further training expect in new codes for the new system expected to be introduced in the coming months. About the new system or projected training, they were as much in the dark as they had been when the current system was introduced.

The paraprofessionals who worked with the data entry clericals expressed concerns about the lack of complete form processing that the clericals were doing. Since the clerical workers had only been trained in specific codes there was little incentive for them to concentrate on the broader concept about how the forms fit into the picture of service provided.

In another agency, the group of clericals performing wordprocessing in a large pool were frustrated that their training didn't prepare them to handle unusual problems which often took up a lot of their time. These workers, former secretaries for the most part, had been sent to training class when they were placed in the wordprocessing pool. They were pleased and proud of the wordprocessing work that they did, but felt that they needed more formal instruction and access to a trainer or technican who could help them solve their reoccuring problems. Informally, they engaged in a lot of information exchange which helped them collectively solve problems and learn new wordprocessing procedures. This, they said, "cost the city a lot of money" since it kept them from getting out the letters they were supposed to produce.

The secretaries in the document creation center in a third agency were satisfied with the training they had received. It is this group that organized their own wordprocessing cluster and participated in the decision about hardware and software purchases.

Training in this agency encompased all of the elements outlined at the beginning of this chapter. A broad spectrum of courses were available for all employees, and introductory classes were integrated with clerical through managerial personnel. Follow-up classes were available in new applications and operating procedures.

Within this agency a great deal of on-the-job informal training took place and was actively encouraged by the Commissioner who through his 'open door' policy, invited employees to drop in and practice new applications.

The training center established for the agency was funded in part by outside grants and operated a retraining program for public assistance women who were trained in wordprocessing and then given temporary training jobs within the agency to practice their skills. The program was a demonstration model and appeared to be successful in a) justifying the creation of the training center to serve a broad population and b) training public assistance recipients in marketable skills.

A cornerstone of the training program was the fact that clerical workers had access to the range of courses available to management. From what we saw this clearly enhanced the motivation and self-esteem of the clericals involved. The center was expanding during the course of our case investigation and had recently hired a training coordinator and was looking for additional trainers. (8)

PROFESSIONALS

The group of professionals who had limited access to a microcomputer located on another floor in their building, complained of "little time to "play" and thus lack of informal training time. These professionals focused their primary need on more computer access time, followed by a desire for training in more applications and the time to experiment.

The professionals who worked in the agency with the training center were generally pleased with the training they had received, but frustrated by the fact that they were too busy to learn new applications. Within this group, where 60 hour work-weeks were not uncommon, the professionals were always so pressed by "another report to get out", that they had no time for formal training.

A central complaint in this group focused not on training, per se, but on the fact that their reliance on the micro computer and its links to a minicomputer network and a mainframe data base, kept them dependent on the technical staff to solve their problems. This was particularly frustrating as the expanded communications system was experiencing more and more "down time". This situat on raised the issue of how much training should be specifically application-oriented and how much should actually included technical training. The professionals experiencing this problem had no recommendations at this time as the problem was just beginning to "heat up".

MANAGERS

The managers using microcomputers were all part of the agency which had its own training center. The managers were satisfied with the training courses, but felt some informal pressure to learn new applications. Interestlingly, the pressure was perceived from peers and secretaries who they thought "knew more than " they did.

The managers, like the professionals, felt that they were too overworked to take advantage of the formal training programs. Most had started out learning wordprocessing in order to do their own reports and then had made use of the electronic mail system to transmit their own memos and notices. Some were branching out to learn spreedsheet programs and others were tapping into existing data bases for on-line inquiry. If training courses were to be more useful for managers and professionals the courses would have to be acknowledged as having priority over some existing work.

We are likely to see that by the end of the "honeymoon and shakedown" periods of the office automation life cycle, all employees from clerical through management would be expected to have working knowledge of wordprocessing and some familiarity with at least one microcomputer application package. For this to happen, training has to be taken out of the realm of individual vendor-sponsored programs and incorporated into formal one-site training courses with informal support available as needed.

Obviously, there are many places where on-site training centers are not feasible. Additionally, the number of workers in need of training will remain very high for the next few years. These two factors point to the urgent need for publically sponsored training facilities at least to bridge this training gap.

PART II : NOTES

7. These attributes of successful training programs where agreed upon by a task force at an international conference sponsored by the International Federation of Information Processing Societies (IFIPS) on Women and Office Automation, Sept. 1984. Here in the States, LaGuardia Community College, City University of New York through its women's Center has implemented a low-cost office automation training program for underemployed women. The course includes the elements discussed here and combines these with counselling and supportive job search assistance. Additionally, in a study conducted for the IBM corporation by Dr. Roberta Mathews of LaGuardia Community Colllege, specific recommendations were made to develop teaching materials and manuals that would be written, in part by workers using the applications. Her suggestions incorporated the idea that people rarely learn on their own , but rather, count heavily on the support of others on their worksite in interpreting manuals and developing their own materials.

8. Managers and placement firms note that the position of microcomputer or wordprocesser trainer is a rapidly growing job category.

PART III : GOVERNMENT RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

GOVERNMENTAL POLICY RECOMMENDATIONS

The preceeding chapters highlighted our case study findings and focused on workplace strategies for confronting immediate problems. While attention to management strategy on the organizational level is important, it does not address longer range implications, nor does it help balance employment problems that are occuring across organizations and industries. These, more far-reaching problems, are now beginning to surface and will clearly become prominent issues within the next few years. We feel that Federal policy, with State and local support is a necessary and viable vehicle for addressing this transformation of the office workplace.

Since the time of the first industrial revolution, governmental policies have played a role in ameliorating major shifts in the economic base of the country. During the first industrial revolution, as early forms of mechanization were applied in the burgeoning factory system, protective legislation was formulated to protect workers against abuses in the industrial workplace. Additionally, support policies were developed to continue to foster agriculture which was in danger of declining as investement in industry mushroomed.

The shift to steam powered mechanization in the second half of the nineteenth century was also a time of major economic upheaval. The U.S. had fully entered the industrial age, and as the majority of the population was employed in this sector of the economy, the effects of a transformed economy were played out on a number of battlefields. This was a period that saw the rise of unions as well as a change in the structure of industry. By the early Twentieth century, management strategies had begun to move toward scientific management, unions were gaining in strength and the shape of industrial policy was being forged within this political and social environment. By the time of the Great Depression, Federal policies had intervened on a number of levels to stabilize an economic environment that had undergone extraordinary upheavals.

By 1960 the U. S. economy had again shifted course and changed from an industrial-based to a service-producing society. This change saw increased employment in the service sector with declining employment in industry. This shift has come to a head in the early 1980's as the declining manufacturing sector and the expanding service and office sectors have brought about serious employment displacement and relocation problems. The introduction of office automation , which some view as a third wave of the technological revolution, is playing a critical role in this transformation. Hardware and software vendors claim that office automation can help cut into the growing number of workers in this sector of the economy. Our study shows that these claims are verifiable. With history as a guide, it seems reasonable that we now take a careful look at the role of government policy.

RECOMMENDATIONS

• **Address training needs:** Governmental programs could sponsor and support ongoing training needs for the entire workforce. Such programs, funded through existing institutions like community colleges, trade unions, high school evening courses, community and women's centers, could reach segments of the population not served by employer or vendor sponsored programs.

Training is an issue that goes beyond the specific problems of an employer or group of employees. Office automation use is reshifting occupational categories and decreasing routine, repetitive clerical job options. It is for these reasons that government sponsored programs are critical for reaching men and women who do not have access to training. While our study shows that training is not readily available to mature and minority women, there are obviously other categories of displaced workers who could benifit from OA training. Private-based training will not serve the needs of a changing labor force, nor would it alleviate the problems of gender and race discrimination that already exist in the office sector. Office automation threatens to cause further bipolarization of job categories. Adequate training must work as a bridge to carry workers from one section of the labor force to another.

Adequate training programs need to address problem-solving skills and abstract concepts. Office systems increasingly require abstract knowledge and transferability of skills. The traditional notion of specific skill has little place in the dynamics of the changing office. Workers who have, for example, word processing skill, coupled with problem-solving training and knowledge of computer applications, are in better positions to cushion themselves against possible job loss. They also represent more valuable human resources to employers who are seeking to adapt to a changing office environment.

• **Recognition of Skill and Compensation and Career Advancement:** Develop governmental guidlelines that recognize the wide-range of skills and concepts used by lower-level office employees and link these with job definitions and appropriate compensation. Such actions could come about in two stages, where the first uses the Federal Civil Service system to introduce model job definition and compensation plans, and the second could use these models as guidelines for other public and private programs. Where appropriate, policies of affirmative action and comparable worth could be applied to more evenly allocate new job definitions and pay scales.

In Europe discussion about office automation focuses on the difference between "visible" or concrete skills and "invisible" skill which includes the less quantifiable aspects of the work environment. Invisibile skill commonly includes, for example, the range of an employee's understanding about a job, such as his or her ability to prioritize work, and use of diplomatic skills to smooth over difficult situations.

Invisible skill needs to be recognized in job definitions for clerial and paraprofessional employees and included in compensation plans. Clearly, the success of office automation is not dependent on the hardware and software employed, but on the range of knowledge employees bring to bear when using the systems. These skills and concepts are included in professional and managerial job descriptions and accompanied by appropriate pay. Since they are also necessary in lower-level jobs they should be recognized and compensated for. The majority of workers at the bottom of the office hierarchy are women. As these women use office automation systems and call upon abstract knowledge and problem-solving skills, these skills need to be included in job definitions and recognized in comprable pay categories.

- **Study Employment Impact:** A fully empowered Office of Employment Impact should be established to examine immediate and short term employment changes and make effective policy plans for longer term strategy. It is generally accepted that the 12 million or so wordprocessors and microcomputers now in office use represent but a trickle compared to the numbered expected to be installed during the next two years. Effects on employment can now be handled through attrition and effective training. But these might be only stop-gap measures if office systems continue to increase productivity across occupational lines.

When office systems are applied to routine or assembly-line work situations they now result in decreased lower-level employment. Currently, office automation use in non-routine or custom-style services is not causing decreased employment among professionals as new work is being generated. If we examine the history of this phenomena in the computer field we find that the same was true as mainframe computers were introduced, but that the effects of the creation of new work did not last long. The number of computer programmmers and operators is not growing as fast as projections from the 1970's would have expected. It seems likely that micro or personal computer office automation can affect the number of professional jobs in offices as it has cut into other professional occupations where automation is used, such as accounting, architecture, programming and manufacturing computer-aided design. Office automation use is still in its "honeymoon" stage.

- **Establish Health and Safety Legislation:** Guidelines and legislation can be established for issues such as glare, lighting, noise and length of time at equipment. Such legislation already exists in Northern Europe and in Japan. The standards could be monitored through existing agencies like NIOSH and the Department of Labor. Such standards could be used by vendors when designing new equipment and by companies when making purchasing decisions. They could also be applied to the office environment as health and safety standards were intended to be applied to other workplaces. In this way, employees working with systems would have the benifit of knowing that the equipment meets Federal standards.

As in any new field, it should be expected that these standards will change over time as research and development efforts find new mechanisms to prevent glare and noise and new sources of indirect lighting. Since only a small percentage of OA equipment is now in use, applying these standards to newly developed equipment is not a severe problem.

- **Research and Development:** Funding for research and development into ongoing issues related to health, stress and the work environment should receive some immediate attention. This type of research should be conducted in actual office settings with active participation from affected occupational categories, rather than in the traditional academic or laboratory setting.

Little is yet known about the interaction of office automation in the social setting of the office. This study, like others conducted within the last year or so, has examined the factors that make up effective OA use. But this is a small beginning. Proper indirect lighting standards, for example, may help cut down on screen glare, but may cause depression among workers in the darker environment. Noise abatement screens for printers can correct this problem, but intensify isolation among clerical workers. The increasingly abstract nature of information handling with OA can lead to psychological problems such as alienation and stress.

Existing studies have laid out the contours of this shifting landscape. Participatory research is needed to paint in the parameters. Over the next two years, as office systems are introduced at rates that are expected to dwarf existing OA introduction, we can expect to see the problems highlighted here to appear as major concerns. Concerted research and legislative action needs to begin now.

CONCLUDING REMARKS
AND SUGGESTIONS FOR FURTHER RESEARCH

This case study set out to explore the effects of office automation on a municipal white-collar workforce. It paid particular attention to the interaction of OA and changes in job content, work organization and the physical environment.

When we looked at changes in job content we found an overall increase in the output per worker. However, this possible index of productivity was not necessarily related to the number or quality of services produced . Increased output simply meant that there was more work being produced per worker, with particularly sharp increases noted in clerical jobs.

We saw that job content was changing with an emphasis on a redefinition of skill. Traditionally, increased skill meant an increase in the number of definable tasks. The application of office automation did result in a growth in the number of definable tasks done, but it also brought about a shift in the type of tasks. Office automation enhances the need for more conceptual knowledge and requires abstract thinking by workers at all occupational levels.

The changing office environment requires an emphasis on "invisible skills", or those abilities that workers view as essential for getting their work done that are not generally included in job descriptions. The lack of recognition of invisible skill in clerical and paraprofessional jobs has meant that office automation has not been used to upgrade these occupational categories. More attention must be paid to the redefinition of skill in order for office automation to have a positive effect on job content for the workers involved.

Changes in job content are affecting job ladders and promotional opportunties . In our case we saw little in the way of promotional paths that could be used to encourage clerical workers to use their invisible skills to gain entry to higher level jobs. As productivity increases cut into the need for clerical workers this could be a serious issue for clerical employees and pose particular problems for women.

Work organization has also undergone change as management plans for introduction of office automation are almost always accomplanied by plans for departmental reorganization. Some changes resulted in centralized work organizations, like clerical pools and combined departments, while others brought about decentralized formats such as clerical clusters and small project teams. Clearly the technology doesn't dictate one form of organizational structure.

Changes in job content and work organization have brought about worker complaints of greater stress among all occupational levels. Increased stress was most noted by clericals and paraprofessionals, indicating an increased intensity of work. At the professional and managerial level employees worked longer hours and noted that they found that they "pushed themselves harder"--again an indicator of work intensification.

Complaints about stress were compounded by health issues raised by problems in the physical environment. Inappropriate lighting, furniture and ventilation were a major source of concern. And these issues were most problematic for clerical workers who spent virtually the entire working day in front of VDT screens. In our study all clerical workers spent approximately seven hours a day "at the machine".

These case study results raise a number of interesting issues that were not included in our project due to time constraints. Issues specifically excluded, but of relevance to future research, include the effects of office automation on : the overall labor market and internal labor markets: emerging work forms such as increases in parttime, temporary and home-based work; and issues of pay scales and comparable worth. The body of this report has focused on results that are supportable within the framework of a case study approach with supplemental use of aggregate data. For the most part, our findings concentrate on short to intermediate term projections. We feel that it would be useful for future research if we were to go beyond the immediate goals of the case and hypothesize some trends that are likely to shape the office landscape of the second half of the 1980's.

Trends

Technology life cycle: According to International Data Resources, a computer market research firm, fourty-one million office automation systems should be in use by 1987. This estimate probably represents the industry's overly optimistic view, but nevertheless suggests a huge jump from the neighborhood of twelve million systems in use today. The wide-spread introduction of office automation within the next two years indicates that the upheavals of the "honeymoon and shakedown" period that characterize the second stage of technological use, will be coming to an end.

The third stage is commonly marked by new inefficiencies that result in changes in the technology. We can begin to see this in the confusion over the use of stand-alone personal computers versus network systems. Wordprocessers and microcomputers were originally introduced as decentralized sysbems to break away from the overburdened organizational problems created by the centralized mainframe computer installations. During the first half of the 1980's they have been viewed as symbols of autonomy by user departments, and, as we have seen, have played a role in shifting power within organizations. But as office systems develop there has been a move toward networking individual work stations in order to combine access to data files and recentralize control over the data. The majority of systems installed in the early '80's have been of the stand-alone variety,[3] but all indications point to network systems as the growth field in the next few years. Clearly networks will solve some of the problems brought about by decentralized control over data, but they will create new issues for coordination and control over information. As we found in the network-style example within our case, the dependence of employees on the system wrecked havoc on their work when the system was "down". Network systems require more complicated hardware connections and software operating systems. We could therefore expect technical difficulties to be a problem in the next few years. We would strongly suggest upcoming research projects to focus on offices where networks are already in place.

Service Type: Our study examined the relationship between the type of service delivered and the organizational form used in service delivery. Basically we looked at production-line form of service delivery as compared to custom-style work. We found that clerical employment in municipal production-line services, like back office employment in the insurance and banking sector, are most affected by office automation. Work that has experienced prior standardization is intensified in an OA environment with the planned for, and expected result, being decreased clerical employment. As more organizations adapt management strategies that standardize and intensify work, we could expect the decline in clerical work to continue throughout the 1980's.

Custom-style services, on the other hand, offer the opportunity for the creation of new work as new projects develop and ideas evolve. Some professional and managerial jobs are done in this environment while others are incorporated into production-like workplaces. Professional and managerial jobs that are coupled with custom-style services could be expected to increase throughout most of the 1980's as both networks and stand-alone systems will generate new ideas and thus new work. But we would expect that the number of new jobs in this area would be quite small compared to the overall number of white-collar jobs. We could also expect to see the number of jobs with "technical" titles expand, however this change will probably parallel the one in the computer and health fields where technical titles mainly fall in the paraprofessional or low-level professional range. It is access to these jobs that employment policy needs to address. We suggest further studies to look at job ladders and career paths to see where occupational mobility may be possible.

Management strategies: As with other forms of automation, the decisive crucible of change will take place within the office environment as management strategies, unions and employee actions shape the workplace. Probably management policies will continue to create centralized work organizations with production environments, and decentralized or team approaches in more custom-style services.

From the perspective of employees, the centralized forms of organization and control appear to cause the least job satisfaction and the most direct antagonism. It is in these areas that boredom and potential productivity declines are more likely. Also, in those organizations where promotional opportunties don't take office automation into account, low morale is a budding problem. These areas will continue to experience increasing unionizing attempts and direct reactions from workers whose jobs are affected.

We feel that research into the ways management policies are handling these changes should be addressed within the next year. Specifically, we would recommend a study that looks at workers who are doing similar tasks using compatible OA equipment, but where different forms of work organization are employed.

Regardless of the work organization, we would expect that issues of job ladders, career mobility, declining employment, and pay will gain in importance for both management strategy and employee response. The issue of declining clerical employment and its link with women's jobs and comprable pay will play an important role in shaping the changes as organizations more toward stage-three technology.

APPENDIX A

MUNICIPAL AGENCIES

Description, Goals and History

Organizational Charts

Number of Employees by Agency

Agency Technology

APPENDIX A

AGENCY DESCRIPTION, GOALS, AND HISTORY

1. Human Resources Administration (HRA)

The HRA is the largest municipal agency in the country, with 24,000 employees and a budget of $4.1 billion dollars. It serves over 1.5 million of New York City's poor and elderly through public assistance, food stamps, Medicaid, day care, shelters and protective services, job placement and training.

HRA's programs are governed and partially funded by State and Federal legislation. Because in 1984 60% of HRA's budget came from State and Federal sources, its programs and automation purchases had to be approved by New York State and Washington. This situation has also led to lengthy delays in obtaining office automation equipment for the Agency.

Goals.

Among HRA's long term management goals are: maximizing quality of services; containing expenditures by implementing cost reductions; maximizing the efficient use of resources (labor, technology, plant, etc.) by streamlining operations. (See HRA Mngt Plan, 1984).

Productivity improvement is seen by many city agencies as the key to achieving these goals. And, specifically office automation technologies are viewed as an important means of productivity improvement. According to the Management Plan, "These technologies provide automated systems to perform time consuming, repetitive, clerical, secretarial and professional tasks so that workers can be assigned to higher value tasks or so that staffing needs can be reduced." (p. 48).

The Department of Income Maintenance states as one of its goals the containing of costs and improvement of efficiency by "expanding office automation to IM centers". In 1984, IM planned to automate many tasks which were performed manually as well as to simplify other manual processes. We observed this plan being implemented at the IM Center in Brooklyn. (p.63)

The Office of Income Support provides services to eligible clients through the Bureau of Child Support (BCS). The BCS mission is to coordinate child support programs throughout NYC and to reduce public assistance costs by locating and collecting child support from responsible parents. The primary method through which BCS planned to meet this goal was through the introduction of the AFS, the Automated Forms System, in their Queens office. (p. 71)

Recent Technological History.

Before 1979, all typing was done manually at the Human

Resources Administration. The Agency was flooded with massive numbers of letters, memos, contracts and procedural forms. Spiraling costs would mean that by 1985 $23 million dollars would be spent on document production. The Office of Management Design (OMD) was brought to the rescue.

OMD, an internal consulting group, developed a plan to automate HRA. They set up a pilot program and ultimately installed Four Phase Systems' Series IV work stations because they offered word processing, data processing and communications in a single system.

Today, twenty-three office systems serve thirty-nine of the fifty two program and administrative support areas in HRA. Two of those systems are in the Income Maintenance Office Automation Pilot project and the other in the Bureau of Child Support.

2. Department of General Services (DGS)

The Department of General Services facilitates the programs of other city agencies through providing a broad range of support services. DGS distributes and maintains municipal supplies and services, produces all city publications, contructs and maintains the park and street light system, provides all construction services, maintains city vehicles and manages WNYC, the public radio station.

DGS has 2500 full time employees and a budget of $350 million for FY 1984. Keeping up with the demand engendered for services by the city government is an enormous task which the DGS has tackled successfully. This Agency is reputed to be on the "cutting edge" of technological and human resource development in the city.

Goals.

Like other agencies in the City of New York, the DGS seeks to improve service delivery, productivity, cost containment and revenue enhancement. The difference may be in the management approach to these goals.

The best way to describe the DGS management approach is "people directed" (see "Today's Office", Jan 1984). DGS set up a Technology Task Force, made up of technical managers from various units within the agency. It's job is to coordinate both existing and emerging technologies. Managers are not the only participants in this process. All employees are encouraged to take part in the selection and implementation of office systems.

Also, once a system is decided upon, management introduces it gradually, reducing the threat often felt by the users of the new technology. Eventually a "clamouring from below" resulted in the more rapid introduction of office automation systems in some units at DGS.

Recent Technological History.

In 1980, wordprocessing was first introduced into the agency. These were small systems, two Wang systems with 23 terminals in two buildings. They performed straight word-processing tasks. These systems were first introduced to those personnel who volunteered to use it. Shortly thereafter, management couldn't keep up with the demand for more wordprocessors.

The Wang system has been upgraded twice since 1980 evolving from a WP to a hybrid system, including data processing applications. It was upgraded to a Wang VS 100 system in 1983. The system is also linked to the city's central IBM mainframe computers to further integrate word and data processing applications.

3. Department of Finance

The Department of Finance administers and collects all taxes, real estate assessments and other money due to the city. It manages and invests city finances, administers the city's payroll and assesses all property.

The Finance Department is a revenue-generating agency. An estimated 90% of its personnel are either directly or indirectly involved in revenue-producing and tax collecting activities. The remaining 10% provide support through executive and administrative services.

Goals.

For 1984, the Department of Finance was targeted for $83 million in additional revenue as part of the city's continuing tax enforcement program. The department was expected to obtain its goal for 1984. In 1985, the Department anticipates collecting $187 million through ongoing and new programs.

Office automation systems have contributed to the Department of Finance efforts to reach its revenue goals. Successful computer match programs and audit tracking systems contributed to the Department reaching its 1984 goals.

Recent Technological History.

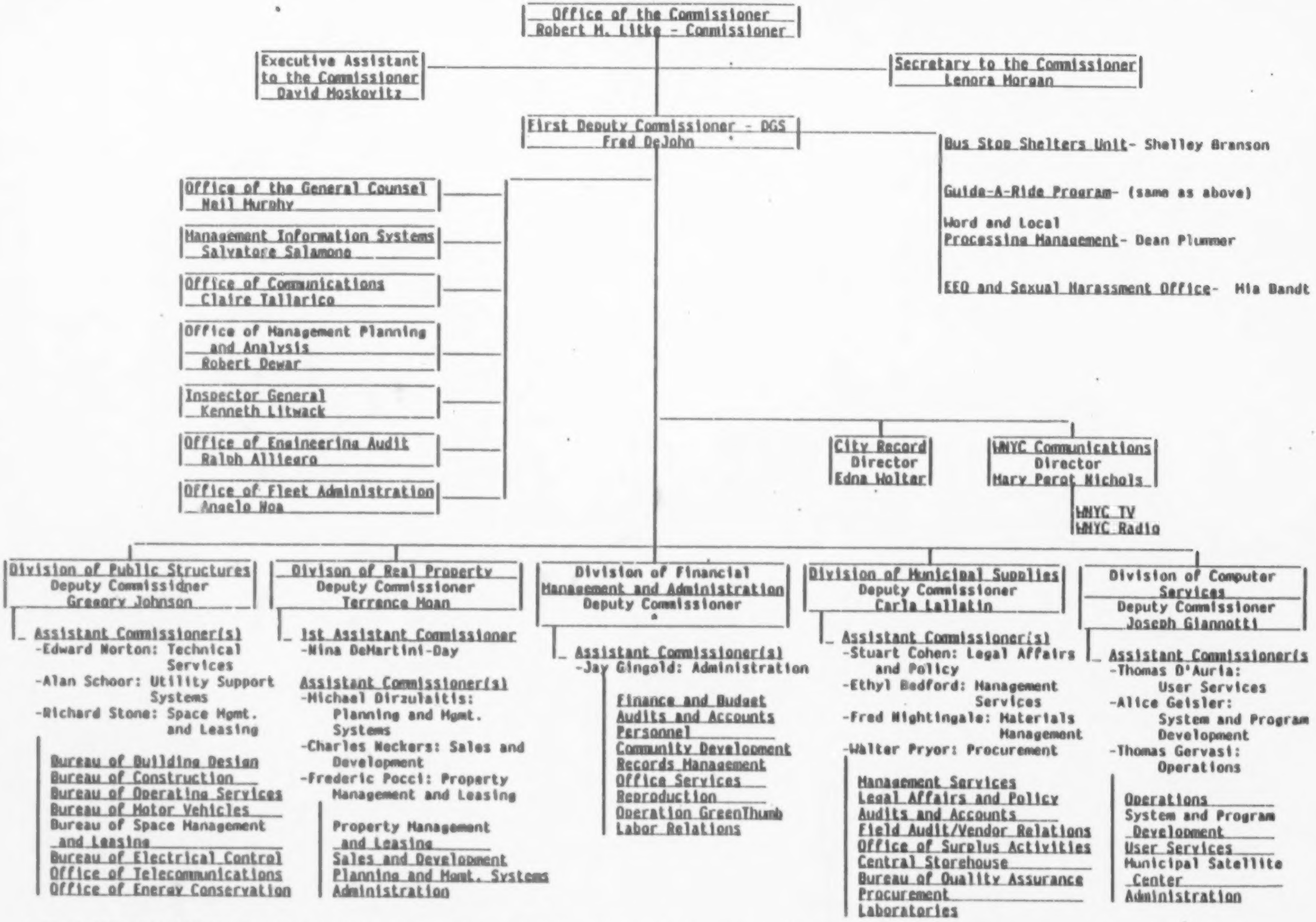
Before 1980, 90% of the work at the Department of Finance was batched, typed and handwritten. The department has a very high volume of correspondence. The previous system was on 3X5 index cards with over 1,500 installment agreement for tax payments tracked on these cards. Although Finance had a central computer (mainframe), it was overworked, taking years to do data tapes.

The consequences of the manual system were that the quality of the letters mailed to taxpayers was low and the productivity of the workers, due to performing of constant repetitive tasks, was low as well. There were also, according to management, few production reports or controls and a general lack of management control over the system and its workers.

Two major changes have been introduced since 1980 to rectify these agency problems: One, is the creation of a centralized word processing pool; and, two is the development of a microcomputer center for tracking of tax records and producing reports.

The agency is requesting 80 more microcomputers. This will probably turn out to be fewer and take about one and a half years.

DEPARTMENT OF IAL SERVICES
Office of th mmissioner



Office of the Commissioner
Robert M. Litke - Commissioner

Executive Assistant to the Commissioner
David Moskovitz

Secretary to the Commissioner
Lenora Morgan

First Deputy Commissioner - DGS
Fred DeJohn

- Bus Stop Shelters Unit- Shelley Branson
- Guide-A-Ride Program- (same as above)
- Word and Local Processing Management- Dean Plummer
- EEO and Sexual Harassment Office- Mia Bandt

- Office of the General Counsel - Neil Murphy
- Management Information Systems - Salvatore Salamone
- Office of Communications - Claire Tallarico
- Office of Management Planning and Analysis - Robert Dewar
- Inspector General - Kenneth Litwack
- Office of Engineering Audit - Ralph Alliegro
- Office of Fleet Administration - Angelo Moa

City Record
Director
Edna Holtar

WNYC Communications
Director
Mary Perot Nichols

- WNYC TV
- WNYC Radio

Division of Public Structures
Deputy Commissioner
Gregory Johnson

- Assistant Commissioner(s)
  - -Edward Norton: Technical Services
  - -Alan Schoor: Utility Support Systems
  - -Richard Stone: Space Mgmt. and Leasing
- Bureau of Building Design
- Bureau of Construction
- Bureau of Operating Services
- Bureau of Motor Vehicles
- Bureau of Space Management and Leasing
- Bureau of Electrical Control
- Office of Telecommunications
- Office of Energy Conservation

Divison of Real Property
Deputy Commissioner
Terrence Moan

- 1st Assistant Commissioner
  - -Nina DeMartini-Day
- Assistant Commissioner(s)
  - -Michael Dirzulaitis: Planning and Mgmt. Systems
  - -Charles Neckers: Sales and Development
  - -Frederic Pocci: Property Management and Leasing
- Property Management and Leasing
- Sales and Development
- Planning and Mgmt. Systems
- Administration

Division of Financial Management and Administration
Deputy Commissioner
*

- Assistant Commissioner(s)
  - -Jay Gingold: Administration
- Finance and Budget
- Audits and Accounts
- Personnel
- Community Development
- Records Management
- Office Services
- Reproduction
- Operation GreenThumb
- Labor Relations

Division of Municipal Supplies
Deputy Commissioner
Carla Lallatin

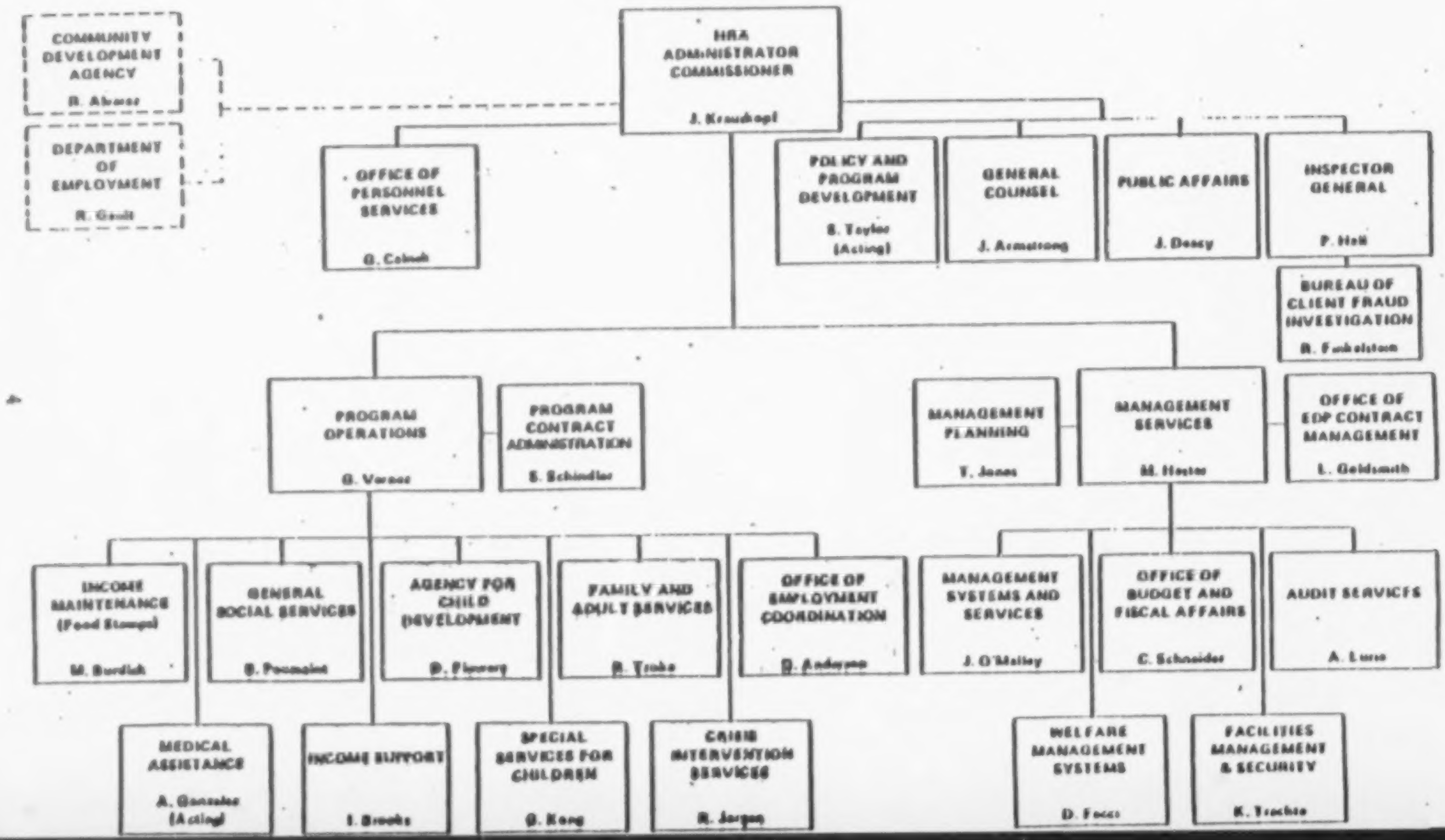
- Assistant Commissioner(s)
  - -Stuart Cohen: Legal Affairs and Policy
  - -Ethyl Bedford: Management Services
  - -Fred Nightingale: Materials Management
  - -Walter Pryor: Procurement
- Management Services
- Legal Affairs and Policy
- Audits and Accounts
- Field Audit/Vendor Relations
- Office of Surplus Activities
- Central Storehouse
- Bureau of Quality Assurance
- Procurement
- Laboratories

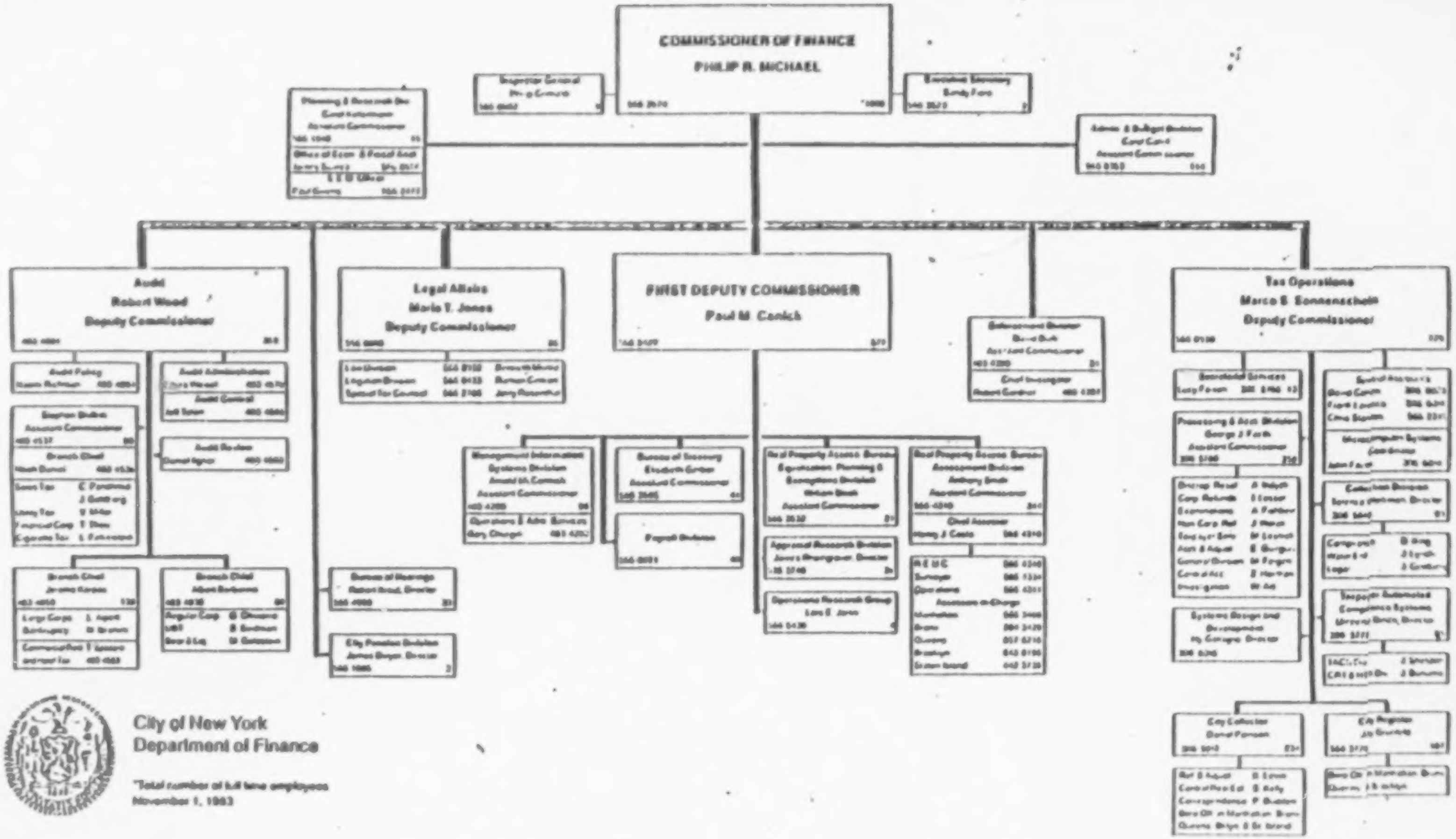
Division of Computer Services
Deputy Commissioner
Joseph Giannotti

- Assistant Commissioner(s
  - -Thomas D'Auria: User Services
  - -Alice Geisler: System and Program Development
  - -Thomas Gervasi: Operations
- Operations
- System and Program Development
- User Services
- Municipal Satellite Center
- Administration

* MR. DEJOHN WILL PERFORM THE ROLE OF DEPUTY COMMISSIONER FOR THE DIVISION OF FINANCIAL MANAGEMENT AND ADMINISTRATION IN ADDITION TO HIS DUTIES AS THE FIRST DEPUTY COMMISSIONER FOR THE DEPARTMENT OF GENERAL SERVICES

NEW YORK CITY
HUMAN RESOURCES ADMINISTRATION
TABLE OF ORGANIZATION


COMMUNITY DEVELOPMENT AGENCY
B. Abreu
DEPARTMENT OF EMPLOYMENT
R. Gault
HRA ADMINISTRATOR COMMISSIONER
J. Krauskopf
OFFICE OF PERSONNEL SERVICES
G. Cohen
POLICY AND PROGRAM DEVELOPMENT
S. Taylor (Acting)
GENERAL COUNSEL
J. Armstrong
PUBLIC AFFAIRS
J. Dossy
INSPECTOR GENERAL
P. Hall
BUREAU OF CLIENT FRAUD INVESTIGATION
R. Finkelstein
PROGRAM OPERATIONS
G. Vernon
PROGRAM CONTRACT ADMINISTRATION
S. Schindler
MANAGEMENT PLANNING
T. Jones
MANAGEMENT SERVICES
M. Hester
OFFICE OF EDP CONTRACT MANAGEMENT
L. Goldsmith
INCOME MAINTENANCE (Food Stamps)
M. Burdick
GENERAL SOCIAL SERVICES
B. Pesmaine
AGENCY FOR CHILD DEVELOPMENT
D. Flaherty
FAMILY AND ADULT SERVICES
B. Trnka
OFFICE OF EMPLOYMENT COORDINATION
D. Anderson
MEDICAL ASSISTANCE
A. Gonzalez (Acting)
INCOME SUPPORT
I. Brooks
SPECIAL SERVICES FOR CHILDREN
G. Kang
CRISIS INTERVENTION SERVICES
R. Jorgen
MANAGEMENT SYSTEMS AND SERVICES
J. O'Malley
OFFICE OF BUDGET AND FISCAL AFFAIRS
C. Schneider
AUDIT SERVICES
A. Lurie
WELFARE MANAGEMENT SYSTEMS
D. Fucci
FACILITIES MANAGEMENT & SECURITY
K. Trachte



City of New York
Department of Finance

*Total number of full time employees
November 1, 1983

NUMBER OF EMPLOYEES BY AGENCY: Mayors' Management
Report, City of New York, September 17, 1984.

	Number of Employees			
		FY84		
Agency	FY83	Planned	Actual	FY85
DGS - FTE	2597	2841	3020	3142
Computer Services FTE	96	112	104	127
HRA				
-FTE	22,932	23,596	23,265	25,137
-FT equivalent of PT	29.5	34.0	28.5	23.0
- Per Diem	927	921	909	830
-Income Maintenance	8465	8698	8635	8923
Finance				
-FTE	1,793	1928	1843	1980
- FTE of.PT	144	n.a.	257	n.a.

AGENCY TECHNOLOGY

Year	Human Resources Adm.	Dept of General Services	Dept. of Finance
1979	6 multi function Four Phase Systems Series IV computers		
1980	Twenty terminals installed by end of 81.	1st agency-wide Wang wordprocessor installed.	
1981	Four Phase introduced into BCS	Set up in-house training center; Expand Wang PC	
1982	Four Phase operational at IM Center	Installation of minicomputer.	Two Xerox 860 wordprocessors brought in for Secy Services.
1983		Wang upgraded into VS 100 Integrates databases and links to IBM mainframe.	More Xerox 860s for Secy Services.
1984	Twenty three office systems serve 39 programs; hoping for 50-60 micros.	115 Wang PCs Wang minicomputers installed.	Total: 34 micros; 20 wordprocessors; 40 - 50 terminals hooked to mainframe; hoping for 250 more wps.

APPENDIX B

CHART: AGENCY, OCCUPATIONAL CATEGORY, GENDER, RACE & AGE

Agencies:	Human Resource Administration (titles)	Department of General Services (titles)	Department of Finance (titles)
Occupational categories:	Clericals: 11 (Clerks/TSAs) Paraprofessionals: 9 (specialists/ investigators) Professionals: 3 (caseworker)	Clericals: 5 (office aide/ PAA/II,III) Professionals: 6 (analysts) Managers: 7 (dept heads/dep. commissioner,etc.)	Clericals: 12 (wp,clerks PAA, OA) Professionals: 7 (audito)
Gender:	all ♀ all ♀ two ♀ one ♂	all ♀ 3 ♀, 3 ♂ 3 ♀, 4 ♂	11 ♀, 1 ♂ 6 ♂, 1 ♀
Race:	6 blacks; 3 hispanics; 2 whites 6 blacks; 2 hispanics; 1 white 2 white♀ 1 black ♂	6 blacks; 2 whites 5 whites, 1 black ♀ 6 whites, 1 hispanic ♂	9 black ♀, 2 hispanic ♀ 1 white ♂ 5 white ♂, 1 black ♂, 1 white ♀
Age:	Between ages 35-55 Between ages 31-50 Between 35-45	2white ♀ 40's. 3 black ♀ in 20's. Between 25-35 Between 28-50	Between 24-50 Between 25-60

CUMULATIVE WORKFORCE ANALYSIS BY EEO CATEGORY

AGENCY New York City Government DEPARTMENT Citywide - (Full-time only) DATE June 30, 1983

EEO Category			MALE EMPLOYMENT						FEMALE EMPLOYMENT						TOTAL EMPLOYMENT				
		Total	White	Black	Hisp	Asian/Pac Is	Amer Ind/Alaskan	Total Males	White	Black	Hisp	Asian Pac Is	Amer Ind/Alaskan	Total Females	White	Black	Hispanic	Asian Pac Is	Amer. Ind/Alaskan
Officials & Administrations	No.	9,816	4,250	618	172	66	4	5,110	2,284	2,184	198	40		4,706	6,534	2,802	370	106	4
	%	8.4	43.3	6.3	1.8	0.7	*	52.1	23.3	22.3	2.0	0.4		48.0	66.6	28.5	3.8	1.1	*
Professionals	No.	17,416	8,530	2,019	546	463	26	11,584	2,453	2,758	467	145	9	5,832	10,983	4,777	1,013	608	35
	%	14.8	49.0	11.6	3.1	2.7	0.2	66.5	14.1	15.8	2.7	0.8	0.1	33.5	63.1	27.4	5.8	3.5	0.2
Technicians	No.	9,713	5,490	1,395	374	142	7	7,408	675	1,411	172	45	2	2,305	6,165	2,806	546	187	9
	%	8.3	56.5	14.4	3.9	1.5	0.1	76.3	7.0	14.5	1.8	0.5	*	23.7	63.5	28.9	5.6	1.9	0.1
Protective Service Workers	No.	36,869	26,124	5,048	2,539	99	22	33,832	1,066	1,610	345	14	2	3,037	27,190	6,658	2,884	113	24
	%	31.4	70.9	13.7	6.9	0.3	0.1	91.8	2.9	4.4	0.9	*	*	8.2	73.7	18.1	7.8	0.3	0.1
Paraprofessionals	No.	3,686	346	1,071	492	16	1	1,926	321	1,192	235	11	1	1,760	667	2,263	727	27	2
	%	3.1	9.4	29.1	13.4	0.4	*	52.3	8.7	32.3	6.4	0.3	*	47.7	18.1	61.4	19.7	0.7	0.1
Office & Clerical	No.	21,835	1,727	1,776	672	59	5	4,239	4,275	11,306	1,860	136	19	17,596	6,002	13,082	2,532	195	24
	%	18.6	7.9	8.1	3.1	0.3	*	19.4	19.6	51.8	8.5	0.6	0.1	80.6	27.5	59.9	11.6	0.9	0.1
Skilled Craft Workers	No.	2,632	2,180	322	93	9	1	2,605	8	17	2			27	2,188	339	95	9	1
	%	2.2	82.2	12.2	3.5	0.4	*	99.00	0.3	0.7	0.1			1.0	83.1	12.9	3.6	0.3	*
Service Maintenance	No.	15,338	10,183	3,307	1,186	33	10	14,719	98	456	64		1	619	10,281	3,763	1,250	33	11
	%	13.1	66.4	21.6	7.7	0.2	0.1	96.0	0.6	3.0	0.4		*	4.8	67.0	24.5	8.2	0.2	0.1
GRAND TOTAL		117,305	58,830	15,556	6,074	887	76	81,423	11,180	20,93	3,34	391	34	35,882	70,010	36,490	9,417	1,278	110
		100.0	50.2	13.3	5.2	0.8	0.1	69.4	9.5	17.9	2.9	0.3	*	30.6	59.7	31.1	8.0	1.1	0.1

Form 2

*Less than 0.1%

CUMULATIVE WORKFORCE ANALYSIS BY EEO CATEGORY

AGENCY Citywide DEPARTMENT DATE June 30, 1982

EEO Category		Total	MALE EMPLOYMENT						FEMALE EMPLOYMENT						TOTAL EMPLOYMENT				
			White	Black	Hisp	Asian/ Pac Is	Amer Ind / Alaskan	Total Males	White	Black	Hisp	Asian Pac Is	Amer. Ind / Alaskan	Total Females	White	Black	Hispanic	Asian Pac. Is.	Amer. Ind / Alaskan
Officials & Administrators	No	9767	4323	613	157	61	4	5150	2293	2095	183	37	1	4609	6616	2708	340	98	5
	%	7.4	44.3	6.3	1.6	0.6	*	52.8	23.5	21.4	1.9	0.4	*	47.2	67.7	27.7	3.5	1.0	0.1
Professionals	No.	19162	9446	2169	622	523	28	12788	2827	2833	501	199	14	6374	12273	5002	1123	722	42
	%	14.6	49.3	11.3	3.2	2.7	0.2	66.7	14.8	14.8	2.6	1.0	0.1	33.3	64.0	26.1	5.9	3.8	0.2
Technicians	No.	10067	5816	1351	357	145	8	7677	739	1443	165	41	2	2390	6555	2794	522	186	10
	%	7.7	57.8	13.4	3.6	1.4	0.1	76.3	7.3	14.3	1.6	0.4	*	23.7	65.1	27.8	5.2	1.8	0.1
Protective Service Workers	No	36611	26619	4879	2334	85	24	33941	966	1413	276	13	2	2670	27585	6292	2610	98	26
	%	27.8	72.7	13.3	6.4	0.2	0.1	92.7	2.6	3.9	0.8	*	*	7.3	75.3	17.2	7.1	0.3	0.1
Para professional		7308	462	1571	623	35	2	2693	1442	2508	631	29	5	4615	1904	4079	1254	64	7
	%	5.6	6.3	21.5	8.5	0.5	*	36.8	19.7	34.3	8.6	0.4	0.1	63.2	26.1	55.8	17.2	0.9	0.1
Office & Clerical	No	25920	2343	2255	856	93	12	5559	5324	12625	2204	103	25	20361	7667	14880	3060	276	37
	%	19.7	9.0	8.7	3.3	0.4	*	21.4	20.5	48.7	8.5	0.7	0.1	78.6	29.6	57.4	11.8	1.1	0.1
Skilled Craft Workers	No	5136	4358	511	174	21	1	5065	21	44	6			71	4379	553	180	21	1
	%	3.9	84.9	9.9	3.4	0.4	*	98.6	0.4	0.9	*			1.4	85.3	10.8	3.5	0.4	*
Service Maintenance	No	17542	11363	3825	1399	44	10	16641	182	609	106	3	1	901	11545	4434	1505	47	1
	%	13.3	64.[illegible]	21.8	8.0	0.3	*	94.9	1.0	3.5	0.6	*	*	5.1	65.8	25.3	8.6	0.3	*
GRAND TOTAL	*	131513	64730	17174	6522	1007	89	89522	13794	23570	4072	505	50	41991	78524	40744	10594	1512	1391
		100	49.2	13.1	5.0	0.8	0.1	68.1	10.5	17.9	3.1	0.4	*	31.9	59.7	31.0	8.1	1.1	0.1

Form 3

*Less than 0.1%

CUMULATIVE WORKFORCE ANALYSIS BY EEO CATEGORY

AGENCY CITY-WIDE DEPARTMENT DATE June 10, 1981

EEO Category		Total	MALE EMPLOYMENT						FEMALE EMPLOYMENT						TOTAL EMPLOYMENT				
			White	Black	Hisp	Asian/ Pac Is	Amer Ind / Alaskan	Total Males	White	Black	Hisp	Asian Pac Is	Amer Ind / Alaskan	Total Females	White	Black	Hispanic	Asian Pac. Is.	Amer. Ind / Alaskan
Officials & Administrators	No.	8945	4045	564	120	52	3	4784	2136	1849	152	22	2	4161	6181	2413	272	74	5
	%	7.7	45.2	6.3	1.3	.6	–	53.5	23.9	20.7	1.7	.2	–	46.5	69.1	27.0	3.0	.8	.1
Professionals	No	17,678	8792	2069	594	448	9	11,912	2454	2682	497	144	9	5766	11,244	4751	1073	592	18
	%	15.3	49.7	11.7	3.4	2.5	.1	67.4	13.9	15.2	2.7	.8	.1	32.6	63.6	26.9	6.1	3.3	.1
Technicians	No	8936	5556	1077	248	110	4	6995	594	1188	124	29	–	1935	6150	2265	372	139	4
	%	7.7	62.2	12.1	2.8	1.2	–	78.3	6.7	13.3	1.4	.3		21.7	68.9	25.4	4.2	1.6	–
Protective Service Workers	No	34,230	25,797	4518	1912	57	18	32,302	690	1059	174	5	–	1928	26,487	5577	2086	62	18
	%	29.6	75.4	13.2	5.6	.2	.1	94.4	2.0	3.1	.5	–	–	5.6	77.4	16.3	6.1	.2	.1
Paraprofessionals		3483	218	1111	565	15	2	1911	172	1205	188	6	1	1572	390	2316	753	21	3
	%	3.0	6.3	31.9	16.2	.4	.1	54.9	4.9	34.6	5.4	.2	–	45.1	11.2	66.5	21.6	.6	.1
Office & Clerical	No.	22,086	1887	1815	609	49	5	4165	4852	11,133	1621	101	14	17,721	6739	12,948	2230	150	19
	%	19.1	8.5	8.2	2.8	.2	–	19.8	22.0	50.4	7.3	.5	.1	80.2	30.5	58.6	10.1	.7	.1
Skilled Craft Workers	No.	2984	2512	338	97	10	1	2958	6	18	2	–	–	26	2518	356	99	10	1
	%	2.6	84.2	11.3	3.6	.3	–	99.1	.2	.6	.1	–	–	.9	84.4	11.9	3.3	.3	–
Service Maintenance	No.	17,203	11,135	3862	1357	44	11	16,409	113	585	93	–	3	794	11,248	4447	1450	44	14
	%	14.9	64.7	22.4	7.9	.3	.1	95.4	.7	3.4	.5	–	–	4.6	65.4	25.9	8.4	.3	.1
GRAND TOTAL		115,539	59,942	15,354	5,502	785	53	81,636	11,015	19,719	2833	107	29	33,903	70,957	35,073	8335	1092	82
		100%	51.9	13.3	4.8	.7	–	70.7	9.5	17.1	2.5	.3	–	29.3	61.4	10.4	7.2	.9	.1

Form 2

CUMULATIVE WORKFORCE ANALYSIS BY EEO CATEGORY

AGENCY City-wide

DEPARTMENT

DATE June 30, 1980

EEO Category		Total	MALE EMPLOYMENT						FEMALE EMPLOYMENT						TOTAL EMPLOYMENT				
			White	Black	Hisp	Asian Pac Is	Amer Ind / Alaskan	Total Male	White	Black	Hisp	Asian Pac Is	Amer Ind / Alaskan	Total Females	White	Black	Hispanic	Asian Pac Is	Amer. Ind / Alaskan
Officials & Administrators	No.	7659	3725	436	90	39	2	4292	1854	1400	93	18	2	3367	5579	1836	183	57	4
	%	6.9	48.6	5.7	1.2	.5	–	56.	24.2	18.3	1.2	.2	–	44.	72.8	24	2.4	.7	.1
Professionals	No.	17926	9179	2019	540	468	5	12211	2514	2636	428	129	8	5715	11693	4655	968	597	13
	%	16.1	51.2	11.3	3	2.6	–	68	14.	14.7	2.4	.7	–	31.9	65.2	26	5.4	3.3	.1
Technicians	No.	8382	5439	971	235	100	4	6749	500	1024	86	21	2	1633	5939	1995	321	121	6
	%	7.5	64.9	11.6	2.8	1.2	–	80.5	6.	12.2	1.0	.3	–	19.5	70.9	23.8	3.8	1.4	.1
Protective Service Workers	No.	33493	26169	4232	1579	34	17	32031	564	822	74	2	–	1462	26733	5054	1653	36	17
	%	30.	78.1	12.6	4.7	.1	.1	95.6	1.7	2.5	.2	–	–	4.4	79.8	15.1	4.9	.1	.1
Paraprofessional.		2922	175	893	458	11	1	1538	151	1087	134	4	1	1384	333	1980	592	15	2
	%	2.6	6.	30.6	15.7	.4	–	52.6	5.4	37.2	4.6	.1	–	47.4	11.4	67.8	20.3	.5	.1
Office & Clerical	No.	21363	2067	1788	566	41	3	4465	4997	10410	1309	81	13	16890	7064	12206	1955	122	16
	%	19.1	9.7	8.4	2.6	.2	–	20.9	23.4	48.0	6.1	.4	.1	79.1	33.1	57.1	9.2	.6	.1
Skilled Craft Workers	No.	3090	2630	326	104	10	1	3071	5	18	2	–	–	25	2635	344	106	10	1
	%	2.0	84.9	10.5	3.4	.3	–	99.2	.2	.6	.1	–	–	.8	85.1	11.1	3.4	.3	–
Service Maintenance	No.	16781	11257	3652	1259	36	11	16215	93	402	70	–	1	566	11350	4054	1329	36	12
	%	15.	67.1	21.8	7.5	.2	.1	96.6	.6	2.4	.4	–	–	3.4	67.6	24.2	7.9	.2	.1
GRAND TOTAL		111622	60641	14317	4831	739	44	80572	10685	17807	2276	255	27	31050	71326	32124	7107	994	71
		100%	54.3	12.8	4.3	.7	–	72.2	9.6	16	2.	.2	–	27.8	63.9	28.8	6.4	.9	.1

Form 8

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CUMULATIVE WORKFORCE ANALYSIS BY EEO CATEGORY

AGENCY CITY-WIDE

DEPARTMENT

DATE June 30, 1979

EEO Category		Total	MALE EMPLOYMENT						FEMALE EMPLOYMENT						TOTAL EMPLOYMENT				
			White	Black	Hisp	Asian/Pac Is	Amer Ind/Alaskan	Total Males	White	Black	Hisp	Asian Pac Is	Amer Ind/Alaskan	Total Females	White	Black	Hispanic	Asian Pac Is	Amer. Ind/Alaskan
Officials & Administrators	No.	5,563	3,351	342	77	20	3	3,793	1,170	536	46	13	2	1770	4521	878	126	33	5
	%	4.8	60.2	6.1	1.4	.4	.1	68.2	21.0	9.6	.9	.2	-	31.8	81.3	15.8	2.3	.6	.1
Professionals	No.	18,417	9,599	2,089	520	393	14	12615	2640	2658	398	92	14	5802	12239	4747	918	485	28
	%	15.8	52.1	11.3	2.8	2.1	.1	68.5	14.3	14.4	2.2	.5	.1	31.5	66.5	25.8	5.0	2.6	.2
Technicians	No.	8,434	5520	1027	254	78	7	6886	495	947	88	17	1	1548	6015	1974	342	95	8
	%	7.2	65.4	12.2	3.0	.9	.1	81.6	5.9	11.2	1.0	.2	-	18.4	71.3	23.4	4.1	1.1	.1
Protective Service Workers	No.	34,183	27368	4062	1403	28	17	32878	505	737	62	1	-	1305	27873	4799	1465	29	17
	%	29.3	80.1	11.9	4.1	.1	-	96.2	1.5	2.2	.2	-	-	3.8	81.5	14.0	4.3	.1	-
Paraprofessionals	No.	3,327	217	1017	450	10	3	1697	203	1268	157	2	-	1630	420	2285	607	12	3
	%	2.9	6.5	30.6	13.5	.3	.1	51.0	6.1	38.1	4.7	.1	-	49.0	12.6	68.7	18.2	.4	.1
Office & Clerical	No.	24574	2620	2200	646	44	8	5518	6068	11453	1429	90	16	19056	8688	13653	2075	134	24
	%	21.0	10.7	9.0	2.6	.2	-	22.5	24.7	46.6	5.8	.4	.1	77.5	35.4	55.6	8.4	.5	.1
Skilled Craft Workers	No.	2,990	2525	318	110	9	-	2962	3	23	2	-	-	28	2528	341	112	9	-
	%	2.6	84.4	10.6	3.7	.3	-	99.1	.1	.8	.1	-	-	.9	84.5	11.4	3.7	.3	-
Service Maintenance	No.	19263	12362	4614	1551	45	13	18585	102	486	88	1	1	678	12464	5100	1639	46	14
	%	16.5	64.2	24.0	8.1	.2	.1	96.5	.5	2.5	.5	-	-	3.5	64.7	26.5	8.5	.2	.1
GRAND TOTAL		116751	63562	15669	5011	627	65	84934	11186	18108	2273	216	34	31817	74748	33777	7284	843	99
		100%	54.4	13.4	4.3	.5	.1	72.7	9.6	15.6	1.9	.2	-	27.3	64.0	28.9	6.2	.7	.1

Form 8

APPENDIX D

Employment and Earnings

Household Data, Annual Averages

1982 and 1983

23. Employed persons by detailed occupation, sex, and race

[Numbers in thousands]

Occupation	1982		
	Total employed	Percent of total	
		Female	Black and other
Total, 16 years and over	99,526	43.5	11.7
White-collar workers	53,470	53.4	9.1
Professional and technical	16,951	45.1	9.7
Accountants	1,193	38.6	9.2
Architects	94	8.3	9.6
Computer specialists	731	28.5	10.0
Computer programmers	434	32.0	10.4
Computer systems analysts	242	26.4	9.9
Engineers	1,374	5.7	6.9
Aeronautical and astronautical engineers	71	4.2	4.2
Civil engineers	199	2.5	9.0
Electrical and electronic engineers	404	4.0	7.7
Industrial engineers	260	14.2	6.9
Mechanical engineers	240	2.9	6.7
Foresters and conservationists	61	6.6	4.9
Lawyers and judges	630	15.4	3.7
Lawyers	606	15.3	3.6
Librarians, archivists, and curators	207	80.7	8.7
Librarians	193	83.4	8.8
Life and physical scientists	320	20.6	9.6
Biological scientists	63	44.0	6.3
Chemists	133	20.3	13.8
Operations and systems researchers and analysts	246	31.7	6.9
Personnel and labor relations workers	423	49.6	11.1
Physicians, dentists, and related practitioners	889	14.6	10.7
Dentists	121	3.3	3.8
Pharmacists	168	23.4	10.1
Physicians, medical and osteopathic	486	14.8	13.8
Nurses, dietitians, and therapists	1,736	91.8	12.6
Registered nurses	1,415	95.6	8.3
Therapists	232	70.6	10.7
Health technologists and technicians	637	72.9	13.7
Clinical laboratory technologists and technicians	266	76.7	16.9
Radiologic technologists and technicians	108	72.2	10.2
Religious workers	347	13.8	6.1
Clergy	285	5.3	7.0
Social scientists	345	38.0	7.5
Economists	200	28.0	7.5
Psychologists	120	55.0	7.5
Social and recreation workers	496	65.5	17.9
Social workers	384	66.4	19.0
Recreation workers	113	61.9	13.3
Teachers, college and university	601	35.4	8.5
Teachers, except college and university	3,264	70.7	10.3
Adult education teachers	79	40.5	15.2
Elementary school teachers	1,434	82.4	11.6
Prekindergarten and kindergarten teachers	271	98.5	12.9
Secondary school teachers	1,231	51.9	6.6
Teachers except college and university, n.e.c.	250	76.0	6.8
Engineering and science technicians	1,116	18.3	10.3
Chemical technicians	95	24.7	16.1
Draftsmen	306	18.1	11.2
Electrical and electronic engineering technicians	314	12.4	11.5
Surveyors	68	1.5	4.4
Technicians, except health, engineering, and science	214	22.9	7.0
Airplane pilots	82	3.6	2.4
Radio operators	63	55.6	7.7
Vocational and educational counselors	166	51.8	13.2
Writers, artists, and entertainers	1,399	42.9	6.7
Athletes and kindred workers	138	30.7	5.1
Designers	221	32.6	5.6
Editors and reporters	204	51.0	5.9
Musicians and composers	149	28.9	10.7
Painters and sculptors	208	51.9	4.8
Photographers	96	22.9	7.3
Public relations specialists and publicity writers	134	50.0	4.5
Research workers, not specified	191	35.6	10.5
All other professional and technical workers	33	47.2	5.7
Managers and administrators, except farm	11,493	28.0	5.7
Bank officials and financial managers	731	37.1	5.1
Buyers and purchasing agents	474	35.7	4.6
Buyers, wholesale and retail trade	195	43.1	5.1
Credit and collection managers	64	48.6	6.3
Health administrators	228	50.9	5.3
White-collar workers—Continued			
Managers and administrators, except farm—Continued			
Inspectors, except construction and public administration	107	15.0	10.3
Managers and superintendents, building	183	52.5	7.7
Office managers, n.e.c.	507	72.6	5.2
Officials and administrators; public administration n.e.c.	430	29.3	9.3
Officials of lodges, societies, and unions	126	28.6	7.9
Restaurant, cafeteria, and bar managers	768	40.6	11.3
Sales managers and department heads, retail trade	353	39.7	7.1
Sales managers, except retail trade	372	12.9	3.0
School administrators, college	130	36.2	13.1
School administrators, elementary and secondary	295	36.2	13.0
All other managers and administrators	6,727	19.9	4.7
Sales workers	6,580	45.6	5.5
Advertising agents and sales workers	138	66.9	3.8
Demonstrators	116	96.0	5.2
Hucksters and peddlers	197	78.2	8.1
Insurance agents, brokers, and underwriters	645	26.2	7.1
Newspaper carriers and vendors	116	29.3	9.5
Real estate agents and brokers	536	50.2	2.4
Stock and bond sales agents	197	19.8	6.1
Sales workers and sales clerks, n.e.c.	4,629	66.4	5.5
Sales representatives, manufacturing industries	383	21.4	3.7
Sales representatives, wholesale trade	1,020	13.9	3.7
Sales clerks, retail trade	2,467	70.8	7.2
Sales workers, except clerks, retail trade	522	19.2	6.6
Sales workers, services and construction	266	42.5	6.9
Clerical workers	18,446	80.7	11.8
Bank tellers	561	92.0	8.0
Billing clerks	154	87.7	6.3
Bookkeepers	1,968	91.8	6.6
Cashiers	1,683	86.8	12.8
Clerical supervisors, n.e.c.	270	72.2	10.7
Collectors, bill and account	87	62.1	11.5
Counter clerks, except food	373	76.6	9.7
Dispatchers and starters, vehicle	110	38.2	7.3
Enumerators and interviewers	53	83.0	11.3
Estimators and investigators, n.e.c.	570	58.4	12.8
Expediters and production controllers	257	42.6	8.9
File clerks	278	86.3	21.2
Insurance adjusters, examiners, and investigators	200	56.5	10.0
Library attendants and assistants	130	81.3	16.0
Mail carriers, post office	266	17.0	14.0
Mail handlers, except post office	182	47.3	20.9
Messengers and office helpers	113	23.5	19.1
Office machine operators	1,107	74.6	17.7
Bookkeeping and billing machine operators	42	85.7	14.3
Computer and peripheral equipment operators	556	63.3	15.3
Keypunch operators	366	96.5	20.3
Payroll and timekeeping clerks	226	82.1	6.9
Postal clerks	271	35.1	26.9
Receptionists	672	97.5	8.3
Secretaries	3,647	99.2	7.4
Secretaries, legal	175	98.6	3.7
Secretaries, medical	85	100.0	5.9
Secretaries, n.e.c.	3,387	99.2	7.5
Shipping and receiving clerks	499	24.8	13.8
Statistical clerks	365	81.6	14.0
Stenographers	66	86.8	13.6
Stock clerks and storekeepers	497	36.8	16.1
Teacher aides, except school monitors	373	92.5	20.1
Telephone operators	283	91.9	17.3
Ticket, station, and express agents	136	67.6	13.0
Typists	962	96.6	17.4
All other clerical workers	1,871	77.9	13.1
Blue-collar workers	29,597	18.7	12.1
Craft and kindred workers	12,272	7.0	8.4
Carpenters	1,082	1.7	5.9
Brickmasons and stonemasons	165	.7	15.9
Cement and concrete finishers	33	—	33.7
Electricians	628	1.6	6.0
Excavating, grading, and road machinery operators	399	1.3	10.3
Painters, construction and maintenance	473	5.5	11.0

23. Employed persons by detailed occupation, sex, and race—Continued

[Numbers in thousands]

Occupation	1982 Total employed	1982 Percent of total: Female	1982 Percent of total: Black and other
Blue-collar workers—Continued			
Craft and kindred workers—Continued			
Plumbers and pipefitters	482	.8	7.5
Structural metal craft workers	81	—	3.7
Roofers and slaters	133	.8	8.3
Blue-collar worker supervisors, n.e.c.	1,686	12.1	7.8
Machinists and job setters	589	3.1	9.7
Job and die setters, metal	76	2.7	9.5
Machinists	513	3.1	9.7
Metal craft workers, excluding mechanics, machinists, and jobsetters	579	3.8	7.6
Millwrights	89	—	3.4
Molders, metal	42	19.0	21.4
Sheetmetal workers and tinsmiths	146	3.4	8.9
Tool and die makers	182	2.5	2.5
Mechanics, automobile	1,236	1.0	9.0
Automobile body repairers	197	1.5	6.6
Automobile mechanics	1,039	.9	9.4
Mechanics, except automobile	2,122	2.4	7.8
Air-conditioning, heating, and refrigeration mechanics	217	—	6.9
Aircraft mechanics	130	3.8	10.8
Data processing machine repairers	84	7.1	10.7
Farm implement mechanics	56	—	7.1
Heavy equipment mechanics, including diesel	944	1.5	7.8
Household appliance and accessory installers and mechanics	150	3.3	7.3
Office machine repairers	78	6.4	9.0
Radio and television repairers	111	5.4	8.1
Railroad and car shop mechanics	45	2.2	15.6
Printing craft workers	454	28.2	7.7
Compositors and typesetters	192	38.0	8.3
Printing press operators	183	12.6	6.6
Bakers	157	47.8	10.2
Cabinetmakers	80	6.3	6.3
Carpet installers	85	1.2	3.9
Crane, derrick, and hoist operators	120	.8	12.5
Decorators and window dressers	123	73.2	4.1
Electric power line and cable installers and repairers	110	.9	10.0
Inspectors, n.e.c.	136	13.2	10.3
Locomotive engineers	37	2.7	2.7
Stationary engineers	193	2.1	8.3
Tailors	23	43.5	8.7
Telephone installers and repairers	304	10.9	9.2
Telephone line installers and repairers	104	4.8	5.8
Upholsterers	61	23.0	9.8
All other craft workers	393	16.9	10.6
Operatives, except transport	9,429	40.7	16.6
Assemblers	1,087	53.8	17.7
Bottling and canning operatives	43	46.5	16.3
Checkers, examiners, and inspectors; manufacturing	729	53.9	16.3
Clothing ironers and pressers	118	76.3	40.7
Cutting operatives, n.e.c.	209	35.4	15.8
Dressmakers, except factory	112	96.4	17.9
Drillers, earth	53	—	3.8
Dry wall installers and lathers	87	1.1	6.9
Filers, polishers, sanders, and buffers	113	30.1	13.3
Furnace tenders, smelters, and pourers, metal	51	7.8	23.5
Garage workers and gas station attendants	320	5.3	11.6
Laundry and dry cleaning operatives, n.e.c.	188	64.3	23.4
Meat cutters and butchers, except manufacturing	183	6.6	9.8
Meat cutters and butchers, manufacturing	93	35.5	17.2
Mine operatives, n.e.c.	222	1.4	6.3
Mixing operatives	78	5.1	21.8
Packers and wrappers, excluding meat and produce	582	60.8	21.0
Painters, manufactured articles	139	15.8	14.4
Photographic process workers	89	48.3	6.7
Precision machine operatives	275	12.4	8.0
Drill press operatives	41	26.8	12.2
Grinding machine operatives	102	8.8	8.8
Lathe and milling machine operatives	83	9.6	6.0
Punch and stamping press operatives	96	38.5	15.6
Sawyers	112	12.5	13.4
Sewers and stitchers	735	95.4	21.6

Occupation	1982 Total employed	1982 Percent of total: Female	1982 Percent of total: Black and other
Blue-collar workers—Continued			
Operatives, except transport—Continued			
Shoemaking machine operatives	72	73.6	11.1
Furnace tenders and stokers, except metal	67	3.0	16.4
Textile operatives	170	63.0	28.3
Spinners, twisters, and winders	97	69.1	32.0
Welders and flame cutters	682	4.8	11.8
Winding operatives, n.e.c.	50	48.0	20.0
All other operatives, except transport	2,854	32.1	16.5
Transport equipment operatives	3,377	8.9	14.7
Bus drivers	354	46.6	21.2
Delivery and route workers	374	9.6	8.7
Forklift and tow motor operatives	326	8.0	19.9
Railroad switch operators	31	—	3.2
Taxicab drivers and chauffeurs	152	9.9	26.3
Truck drivers	1,841	2.1	13.5
All other transport equipment operatives	99	2.2	17.2
Nonfarm laborers	4,518	11.7	17.4
Animal caretakers	101	35.4	4.0
Construction laborers including carpenters' helpers	786	3.2	18.8
Freight and material handlers	896	9.8	18.0
Garbage collectors	73	2.7	[illegible]
Gardeners and groundskeepers, except farm	722	5.0	17.9
Timber cutting and logging workers	91	1.1	13.2
Stockhandlers	977	24.5	13.0
Vehicle washers and equipment cleaners	183	13.7	21.3
Warehouse laborers, n.e.c.	278	4.8	16.9
All other nonfarm laborers	616	9.4	17.2
Service workers	13,736	61.9	19.7
Private household	1,042	96.9	29.9
Child care workers	449	97.4	9.8
Cleaners and servants	475	95.9	46.3
Housekeepers	118	98.2	39.1
Service workers, except private household	12,694	59.0	18.8
Cleaning workers	2,519	38.3	27.5
Lodging quarters cleaners	186	96.2	37.3
Building interior cleaners, n.e.c.	925	37.9	29.0
Janitors and sextons	1,408	17.6	25.2
Food service workers	4,760	65.7	14.3
Bartenders	362	50.8	5.0
Waiters' assistants	231	19.9	13.4
Cooks	1,396	49.9	21.0
Dishwashers	272	27.6	18.4
Food counter and fountain workers	463	84.9	12.1
Waiters	1,494	88.6	7.8
Food service workers, n.e.c.	560	76.6	23.0
Health service workers	2,022	89.7	26.7
Dental assistants	151	98.0	3.3
Health aides, excluding nursing	333	86.2	18.0
Nursing aides, orderlies, and attendants	1,138	87.1	31.3
Practical nurses	400	97.0	19.3
Personal service workers	1,850	76.9	14.5
Attendants	335	54.6	11.9
Barbers	100	12.0	15.0
Child care workers	472	96.2	14.2
Hairdressers and cosmetologists	573	89.5	6.9
Housekeepers, excluding private household	182	69.8	23.1
Welfare service aides	90	93.3	37.8
Protective service workers	1,566	10.9	15.1
Firefighters	218	.5	9.2
Guards	685	12.7	21.3
Police and detectives	505	6.7	10.5
Sheriffs and bailiffs	77	11.7	13.0
Farm workers	2,723	17.3	7.2
Farmers and farm managers	1,452	11.8	2.1
Farmers (owners and tenants)	1,415	11.9	2.1
Farm laborers and supervisors	1,271	24.1	13.1
Farm laborers, wage workers	987	15.4	18.1
Farm laborers, unpaid family workers	244	61.9	1.2

NOTE: N.E.C. is an abbreviation for "not elsewhere classified" and designates broad categories of occupations which cannot be more specifically identified.

22. Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1992			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Technical, sales, and administrative support	31,265	64.8	7.8	4.3
Technicians and related support	3,053	48.2	8.2	2.1
Health technologists and technicians	1,111	84.3	12.7	3.1
Clinical laboratory technologists and technicians	286	76.2	10.8	2.9
Dental hygienists	88	98.6	1.6	(1)
Radiologic technicians	101	71.7	8.6	4.8
Licensed practical nurses	443	97.0	17.7	2.1
Engineering and related technologists and technicians	822	18.4	6.1	3.6
Electrical and electronic technicians	380	12.5	8.2	4.6
Drafting occupations	273	17.5	5.5	2.3
Science technicians	202	38.1	6.6	2.8
Biological technicians	52	37.7	2.9	2.0
Chemical technicians	82	28.9	9.8	3.6
Technicians, except health, engineering, and science	917	38.3	5.0	2.7
Airplane pilots and navigators	88	2.1	(1)	1.8
Computer programmers	443	32.6	4.4	2.1
Legal assistants	136	74.0	4.3	3.8
Sales occupations	11,818	47.8	4.7	3.7
Supervisors and proprietors	2,966	28.4	3.6	3.4
Sales representatives, finance and business services	1,863	37.2	2.7	2.2
Insurance sales	561	28.1	3.6	2.5
Real estate sales	570	48.4	1.3	1.5
Securities and financial services sales	212	23.6	3.1	1.1
Advertising and related sales	124	47.9	4.6	3.3
Sales occupations, other business services	396	41.0	2.4	2.9
Sales representatives, commodities, except retail	1,442	15.1	2.1	2.2
Sales workers, retail and personal services	5,511	66.7	6.7	4.8
Sales workers, motor vehicles and boats	230	6.4	3.2	3.6
Sales workers, apparel	461	83.2	6.1	6.0
Sales workers, shoes	117	66.4	5.0	7.3
Sales workers, furniture and home furnishings	140	48.8	2.7	4.6
Sales workers, radio, television, hi-fi, and appliances	134	30.4	5.0	6.2
Sales workers, hardware and building supplies	189	22.7	2.6	3.6
Sales workers, parts	140	10.8	1.8	6.2
Sales workers, other commodities	1,441	74.1	4.6	4.0
Sales counter clerks	140	70.1	7.8	4.3
Cashiers	2,009	84.4	10.1	5.4
Street and door-to-door sales workers	370	61.0	4.4	3.4
News vendors	143	27.4	5.6	2.9
Sales-related occupations	84	56.7	2.8	1.3
Administrative support, including clerical	18,386	79.8	8.8	5.0
Supervisors	679	53.4	9.3	5.0
General office	388	65.7	10.6	4.9
Financial records processing	93	62.2	5.8	5.1
Supervisors, distribution, scheduling, and adjusting clerks	186	22.7	8.9	6.3
Computer equipment operators	806	63.9	12.5	6.0
Computer operators	587	63.7	12.1	6.0
Secretaries, stenographers, and typists	4,281	98.2	7.3	4.8
Secretaries	3,861	99.0	6.8	4.8
Stenographers	86	96.7	6.4	2.0
Typists	606	95.6	13.8	6.4
Information clerks	1,174	86.9	8.6	5.6
Interviewers	164	89.0	8.7	4.8
Hotel clerks	64	66.6	8.7	3.2
Transportation ticket and reservation agents	96	64.7	10.3	6.7
Receptionists	622	96.6	7.5	6.6
Records processing occupations, except financial	896	82.4	12.6	4.8
Order clerks	188	78.1	10.6	4.4
Personnel clerks, except payroll and timekeeping	94	91.1	14.9	4.6
Library clerks	147	81.9	18.4	2.5
File clerks	287	83.5	16.7	6.1
Records clerks	157	82.8	11.8	5.6
Financial records processing	2,457	89.4	4.6	3.7
Bookkeepers, accounting, and auditing clerks	1,870	91.0	4.3	3.3
Payroll and timekeeping clerks	192	82.2	5.8	5.0
Billing clerks	146	88.4	6.2	2.8
Cost and rate clerks	56	75.6	5.8	6.3
Billing, posting, and calculating machine operators	53	66.5	8.4	6.9
Duplicating, mail and other office machine operators	66	62.6	16.8	6.1
Communications equipment operators	256	88.1	17.0	4.4
Telephone operators	244	90.4	17.0	4.3
Mail and message distributing occupations	790	31.6	16.1	4.6
Postal clerks, except mail carriers	246	36.7	26.2	6.2
Mail carriers, postal service	259	17.1	12.6	2.7
Mail clerks, except postal service	170	50.8	15.8	3.9
Messengers	122	26.2	18.7	6.2
Material recording, scheduling, and distributing clerks	1,842	37.5	10.8	6.6
Dispatchers	187	46.7	11.4	4.3
Production coordinators	192	44.8	6.1	2.2
Traffic, shipping, and receiving clerks	421	22.8	8.1	11.1
Stock and inventory clerks	532	38.7	13.3	6.6
Weighers, measurers, and checkers	79	47.2	16.8	5.8
Expediters	112	57.5	8.4	4.3

See footnotes at end of table.

22. Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1983 Total employed	Percent of total Women	Percent of total Black	Percent of total Hispanic origin
Adjusters and investigators	675	69.9	11.1	5.1
Insurance adjusters, examiners, and investigators	199	65.0	11.5	3.3
Investigators and adjusters, except insurance	301	70.1	11.3	4.8
Eligibility clerks, social welfare	69	88.7	12.9	9.4
Bill and account collectors	106	66.4	8.5	6.6
Miscellaneous administrative support	2,397	85.2	12.5	5.9
General office clerks	648	80.6	12.7	7.2
Bank tellers	480	91.0	7.5	4.3
Data-entry keyers	311	93.6	18.6	5.6
Statistical clerks	96	75.7	7.5	3.4
Teachers' aides	348	93.7	17.8	12.8
Service occupations	13,857	60.1	16.6	6.8
Private household	980	96.1	27.8	6.5
Child care workers	408	96.9	7.9	3.6
Cleaners and servants	512	95.8	42.4	11.8
Protective service	1,672	12.8	13.6	4.6
Supervisors, protective service	127	4.7	7.7	3.1
Supervisors, police and detectives	58	4.2	9.3	1.2
Firefighting and fire prevention	189	1.0	6.7	4.1
Firefighting occupations	170	1.0	7.3	3.8
Police and detectives	645	9.4	13.1	4.0
Police and detectives, public service	412	5.7	9.5	4.4
Sheriffs, bailiffs, and other law enforcement officers	87	13.2	11.5	4.0
Correctional institution officers	146	17.8	24.0	2.8
Guards	711	20.6	17.9	5.6
Guards and police, except public service	602	13.0	18.9	6.2
Service occupations, except private household and protective service	11,205	64.0	16.0	6.9
Food preparation and service occupations	4,860	63.3	10.5	6.8
Supervisors	228	63.6	10.8	5.0
Bartenders	338	48.4	2.7	4.4
Waiters and waitresses	1,357	87.8	4.1	3.6
Cooks, except short order	1,185	50.8	18.0	6.6
Short-order cooks	60	28.6	12.9	3.4
Food counter, fountain, and related occupations	326	76.0	9.1	6.7
Kitchen workers, food preparation	138	77.0	13.7	8.1
Waiters' and waitresses' assistants	364	38.8	12.6	14.2
Miscellaneous food preparation	648	54.0	16.1	11.8
Health service occupations	1,739	89.2	23.5	4.8
Dental assistants	154	98.1	6.1	5.7
Health aides, except nursing	316	86.8	16.5	4.8
Nursing aides, orderlies, and attendants	1,269	88.7	27.3	4.7
Cleaning and building service occupations	2,736	38.8	24.4	9.2
Supervisors	134	22.4	28.3	8.6
Maids and housemen	531	81.2	32.3	10.1
Janitors and cleaners	2,071	28.6	22.6	8.8
Personal service occupations	1,870	79.2	11.1	6.0
Barbers	92	12.9	8.4	12.1
Hairdressers and cosmetologists	622	88.7	7.0	5.7
Attendants, amusement and recreation facilities	131	40.2	7.1	4.3
Public transportation attendants	63	74.3	11.3	5.5
Welfare service aides	77	92.5	34.3	10.6
Child care workers	389	96.6	12.6	5.2
Precision production, craft, and repair	12,328	8.1	6.8	6.2
Mechanics and repairers	4,158	3.0	6.8	5.3
Supervisors	362	7.9	2.7	3.3
Mechanics and repairers, except supervisors	3,906	2.8	7.0	5.5
Vehicle and mobile equipment mechanics and repairers	1,683	.8	6.9	6.0
Automobile mechanics	800	.5	7.8	6.0
Bus, truck, and stationary engine mechanics	286	.8	8.5	5.7
Aircraft engine mechanics	95	2.5	4.0	7.8
Small engine repairers	63	.1	6.4	3.4
Automobile body and related repairers	199	.7	6.5	6.5
Heavy equipment mechanics	162	.7	5.4	4.0
Industrial machinery repairers	539	2.3	6.8	4.0
Electrical and electronic equipment repairers	674	7.4	7.3	4.8
Electronic repairers, communications, and industrial equipment	166	8.5	6.0	8.1
Data processing equipment repairers	98	9.3	6.1	4.6
Telephone line installers and repairers	59	5.6	5.8	4.6
Telephone installers and repairers	247	8.8	7.8	3.7
Heating, air conditioning, and refrigeration mechanics	280	.3	6.0	6.2
Miscellaneous mechanics and repairers	792	4.0	7.8	5.4
Office machine repairers	68	3.3	9.3	3.8
Millwrights	94	1.0	6.4	2.4

See footnotes at end of table.

APPENDIX E

Sample of Job Descriptions

JOB DESCRIPTION FOR LOCATION GROUP CLERK

Under supervision of Location Group Supervisor with little latitude for independent decision of action, is responsible for the clerical work within a Location Group.

Regularly:

- Distributes cases to Location Investigator.
- Searches for and retrieves cases requested by Location Investigator.
- Prepares weekly statistical activity reports.
- Maintains running worker activity totals for weekly group report.
- Picks up and delivers Location Group's mail.
- Maintains Wage Reporting System Clearance on cases.
- Maintains Holding File
- Maintains redetermination cards.
- Pulls redetermination cards by due date.

JOB DESCRIPTION FOR LOCATION INVESTIGATOR

Under general supervision of a Location Group Supervisor, with some latitude for individual action or decision, is responsible for the location of absent parents, for the purpose of establishing paternity and/or securing support payments for dependent children of the absent parents.

Regularly:

- Follows up on information provided by client on referral from an Income Maintainence Center or information provided from the Pre-Acceptance Interview (i.e., address of absent parent, former and current employers, relatives and friends). This is accomplished by telephone, correspondence, and/or field visits.
- Interviews clients to obtain additional leads; follows up on those leads
- Obtains and reviews necessary documents (i.e., birth and/or death certificates; copies of separation or divorce agreements; marriage certificates or any other document which may have bearing on the case).
- Sends out clearance forms to various private and governmental agencies in an attempt to locate the absent parent.
- Makes field visits to expedite work (i.e., contacts with landlords, friends neighbors, and relatives; or with absent parent if located) when necessary.
- Discusses and sets up voluntary contributions of support by absent parent.
- Prepares court referral packages to obtain orders of support.
- Records all efforts in a case record, developed to show case progress.
- Completes and forwards necessary forms for input into data base.
- Prepares weekly case activity reports.

JOB DESCRIPTION FOR PREASSIGNMENT WORKER

Under supervision of a Preassignment Group Supervisor, with some latitude for independent decision and action, is responsible for screening cases to determine priority for assignment.

Regularly:

- Screens referrals/materials on new and undercare cases, utilizing the CRT and ASCU screens.
- Reviews redetermination file at predetermined intervals.
- Makes telephone contacts with absent parents/clients in selected cases.
- Makes other telephone contacts to verify locate or other information.
- Registers/updates Parent Locator Service information; reviews responses to determine priority for assignment.
- Completes Wage Reporting System clearances when necessary and monitors responses to determine priority assignments.
- Completes conversion requests.
- Updates cases on the automated BCS absent aarent file.
- Updates ASCU System via Change Requests.
- Forwards selected cases to Administrative Assistant to Borough Director for special handling.

OFFICE WORKER
OCCUPATIONAL GROUP

CODE NO. 10303

ASSOCIATE WORD PROCESSOR

General Statement of Duties and Responsibilities

Under general supervision with latitude for independent initiative and judgment, performs assignments involving complex problems in word processing production, and/or acts as lead operator (supervising two or more operators).

Examples of Typical Tasks

Initiates less experienced word processing equipment users in the application of advanced methods.

Oversees and supervises assigned staff in production of large assignments including several word processing operators. Reviews and edits completed assignments for accuracy and compliance with assignment instructions.

Schedules the production of the word processing of large volumes of documents or reports.

Qualification Requirements

Two years of progressively responsible experience in the performance of word processing duties, as described in Assignment Levels I, II, and III of the class specification of Word Processor.

Direct Lines of Promotion

From:	Word Processor (10302) (Assignment Level III)	To:	Principal Administrative Associate (10124)

OFFICE WORKER OCCUPATIONAL
GROUP

CODE NO. 10104

ELIGIBILITY SPECIALIST

General Statement of Duties and Responsibilities

This position encompasses the performance of tasks, under supervision with some latitude for independent action or decision. This work is performed under well-defined procedures of the Department of Social Services in Income Maintenance, Food Stamps and Medical Assistance; determining and verifying initial and continuing eligibility for Public Assistance, Medicaid and Food Stamps through the use of agency procedures, automated systems and/or based on face to face client interviews; all personnel perform related work.

There are three assignment levels in this class of positions; the following are examples of typical tasks:

Assignment Level I

Determines initial eligibility, or verifies continuing eligibility and re-applications for Medicaid, Food Stamps and/or Public Assistance via use of agency procedures and automated systems with incidental or no face to face client contact.

Receives and reviews all required documents from client/applicants to determine eligibility for Public Assistance, Medicaid and/or Food Stamps.

Computes and determines the amount of financial assistance for Public Assistance, Food Stamps and/or Medicaid for eligible participants.

Forwards case records and other documentation for supervisory review and approval.

Authorizes statistical and financial changes in assistance and/or budgets resulting from information received from active clients and prepares all required forms to effect processing.

Maintains records to provide a continuing history of pertinent action in each case.

Assumes responsibility for substantiating the reason for evaluation in all eligibility decisions.

Prepares reports on activities and makes other reports as required.

ELIGIBILITY SPECIALIST (Cont'd)

Assignment Level II

Performs duties as described in Level I in direct client contact.

Conducts face to face interviews with clients/applicants to determine initial eligibility, or to verify continuing eligibility and reapplications for Medicaid, Public Assistance and/or Food Stamps.

Makes referrals during interview for other services; prepares necessary memoranda for referral.

Assignment Level III

Performs duties as described in Levels I and II within a caseload concept Income Maintenance Center.

Maintains a caseload of clients as assigned by the group supervisor.

Determines appropriate employability status of members of households of clients/applicants, refers to employment programs, takes required case actions based upon employability coding.

Makes appropriate entries in public assistance case records; provides assistance and instructs applicant; computes budget amounts of public assistance grants; prepares and verifies documentation from clients; takes required actions to provide public assistance grants.

Contacts landlords/agents and/or other agencies/officials to obtain or maintain suitable housing for clients/applicants; processes all housing actions such as rent increases, change of address, rent advances and relocation.

Qualification Requirements

1. An associate degree from an accredited college or completion of two (2) years of study (60 credits) at an accredited college; or

2. A high school diploma, or evidence of having passed an examination for the high school equivalency diploma, and two (2) years of full-time, paid experience in the following areas: interviewing for the determination of eligibility for public assistance, unemployment, health or other insurance benefits; bookkeeping; preparation of statistical reports; validation of vouchers, warrants, invoices; or comparable job related experience; or two (2) years of responsible clerical or administrative experience in the Department of Social Services; or

3. Education and/or experience equivalent to "1" or "2" above, but all candidates must have a high school diploma or its equivalent.

Direct Lines of Promotion

FROM: None

TO: Principal Administrat
Associate (10124)

COMPUTER TECHNICAL SUPPORT
OCCUPATIONAL GROUP

CODE NO. 13610

TECHNICAL SUPPORT AIDE

Duties and Responsibilities

This class of positions encompasses either the performance of data processing functions in the areas of Library, Data Entry, Production Control and Data Control/Coding, or supervising personnel performing these data processing functions. There are four assignment levels within this class of positions. All personnel perform related work.

ASSIGNMENT LEVEL Ia

Under direct supervision, performs routine data processing functions in one of the areas described below; and responsible clerical work which may include but is not limited to typing and the preparation of statistical reports.

ASSIGNMENTS LEVEL Ib

Under direct supervision, with some latitude for independent initiative and judgment, performs the data processing functions or may supervise personnel performing routine functions in the areas described below; and performs other clerical work related to these data processing functions. Must have at least one year of experience in Level Ia.

ASSIGNMENT LEVEL II

Under supervision, with latitude for independent initiative and judgment, performs complex data processing functions or supervises personnel performing routine functions in the areas described below.

ASSIGNMENT LEVEL III

Under supervision, with considerable latitude for independent initiative and judgment, performs more complex assignments and supervises personnel performing data processing functions in one of the following areas. Must have at least one year of experience in Level II.

Library

Maintains tape and disk log.
Provides files to Operations Section in accordance with the production schedule.
Cleans tape files and schedules files for recertification or retirement.
Monitors files stores in off-site security areas.
Labels new tape files and maintains a historical log of relevant data on each shipment of tapes and disks.
Files all library materials in an orderly and uniform manner.
Conducts a periodic inventory of the library.
Maintains program and program documentation libraries.

TECHNICAL SUPPORT AIDE (cont'd)

Data Entry

Enters information into a computerized system using a terminal.
Enters information from source documents or coded forms.
Insures that the sequence of the input documents is maintained and errors on documents or missing documents are brought to the attention of the supervisor.
Makes the assignments and checks the work of data entry personnel.

Production Control

Insures that all steps of processing are completed.
Balances control totals to insures output validity.
Directs the distribution of system outputs.
Maintains documentation required for Production Control Unit.
Monitors system audit trials and error reports for persistent input errors so that remedies can be proposed.
Loads cards, tapes, forms and performs related functions

Data Control/Coding

Collects input documents for entry into a computerized system.
Codes information from a source document onto a coding form for later entry into a computerized system.
Reviews input forms for completeness and accuracy by comparing information on an inquiry terminal against the information on the source document.

Qualification Requirements

1. Graduate from a senior high school or evidence of having passed an examination for a high school equivalency diploma and one (1) year of satisfactory full-time, paid clerical experience; or

2. A satisfactory equivalent.

Direct Lines of Promotion

From:	Office Aide (10109) ((personnel employed in computer related activities)	To:	Computer Associate (Technical Support) (13611)

APPENDIX F

Job Titles and Promotion Lines, Salary Range

I. CLERICAL TITLES

Title	Date Established	Bargaining Representative in Mayoral Agencies	# of Employees in Mayoral Agencies 12/84*	# of Employees in Mayoral Agencies 7/81*
1. **Technical Support Aide** (broadbanded from clerical titles to perform data entry & retrieval)	12/77	DC & Local 1549 AFSCME	Total: 606 HRA: 242 DGS: 21	529 217 13
	12/77	DC 37 & Local 1113 AFSCME	Total: 11 Finance: 11	17 17
2. **Office Aide** (broadbanded; several entry-level clerical titles & functions collapsed into one)	11/77	DC 37 & Local 1549 AFSCME	Total: 7,164 HRA: 3,212 DGS: 126	7,664 3,607 190
	11/77	DC 37 & Local 1113 AFSCME	Total: 55 Finance: 537	541 541
3. **Office Associate** (broadbanded; several middle-level clerical titles & functions collapsed into one)	11/77	DC 37 & Local 1549 AFSCME	Total: 4,307 HRA: 1,743 DGS: 197	7,183 4,997** 60
	11/77	DC 37 & Local 1113 AFSCE	Total: 226 Finance: 222	93 92
4. **Word Processor** (reclassification from Office Aide or Office Assoc. has not been completed, so employee counts are not accurate)	1/84	DC 37 & Local 1549 AFSCME	Total: 15	NA
	1/84	DC 37 & Local 1113 AFSCME	Total: 16 Finance: 16	

---

* Employee Counts are derived from the D.C. 37 Membership Data Base, which are derived from NYC payroll data; totals are for Mayoral Agencies, including the HHC.

** A large number of Office Associates Level III in HRA were reclassified to the Title Eligibility Specialist (see II).

II. PARAPROFESSIONAL TITLES

	Title	Date Established	Bargaining Representative in Mayoral Agencies	# of Employees in Mayoral Agencies 12/84*	# of Employees in Mayoral Agencies 7/81*
1.	Eligibility Specialist (reclassified from Office Associate Level III)	4/82	DC 37 & Local 1549 AFSCME	Total: 4,541 HRA: 4,541	NA
2.	Investigator	1/75	DC 37 & Local 371 or Local 1113, AFSCME	Total: 182 HRA (371): 129	299 164

III. PROFESSIONAL TITLES

1.	Tax Auditor (employees were reclassified into this title from Accountant title series)	5/83	DC 37 & Local 1407 AFSCME	Total: 128 Finance: 125	NA
2.	Caseworker	1/65	DC 37 & Local 371 AFSCME	Total: 2,898 HRA: 2,882	3,132 3,113
3.	Staff Analyst	4/77	None	NA	NA

---

* Employee Counts are derived from D.C. 37 Membership Data Base, which are derived from NYC payroll data; totals are for Mayoral Agencies, including the HHC.

IV. MISCELLANEOUS

Title	Date Established	Bargaining Representative in Mayoral Agencies	# of Employees in Mayoral Agencies 12/84*	# of Employees in Mayoral Agencies 7/81*
1. Community Assistant	12/75	DC 37 & Local 371 AFSCME	Total 620	520
2. Community Associate	12/75	DC 37 & Local 371, AFSCME	Total: 482	73
3. Principal Administrative Associate	11/77	Local 1180, CWA	NA	NA

---

* Employee Counts are derived from D.C. 37 Membership Data Base, which are derived from NYC payroll data: totals are for Mayoral Agencies, including the HHC.

CLERICAL & RELATED TITLES

	Title	7/1/83 Salary Range		
1.	Office Aide (10109) (after 5 years of service in title, automatic maturation to Level III minimum	$12,591-18,177	Level I:	$12,591-15,251
			Level II:	$13,016-17,740
			Level III:	$14,030-18,177
	promotes to			
2.	Office Associate (10112)	$15,543-20,511		
	promotes to			
3.	Principal Administrative Associate (10124)	$20,111-33,082	Level I:	$20,111-25,619
			Level II:	$22,502-28,445
			Level III:	$24,894-33,082
4.	Technical Support Aide (13610)	$13,016-23,331	Level Ia:	$13,016-16,030
			Level Ib:	$14,030-18,177
			Level II:	$15,543-21,895
			Level III:	$17,091-23,331
	promotes to			
5.	Computer Associate (Technical Support) (13611)	$21,778-41,639	Level I:	$21,778-27,575
			Level II:	$26,126-33,373
			Level III:	$31,178-41,639
6.	Word Processor (10302) (after 6 months' experience, automatic maturation to Level II; after an additional 12 months, automatic maturation to Level III)	$13,016-21,895	Level I:	$13,016-16,030
			Level II:	$14,030-18,177
			Level III:	$15,543-21,895
	promotes to			
	Associate Word Processor (10303)	$17,091-23,331		

PARAPROFESSIONAL & PROFESSIONAL TITLES

	Title	7/1/83 Salary Range
1.	Community Assistant (56056) (This is a non-competitive title, so no promotional ladder.)	$13,725-15,456
2.	Community Associate (56057) (This is a non-competitive title)	$16,150-23,372
3.	Investigator (31105)	$17,478-23,372
	promotes to	
4.	Senior Investigator (31110)	$21,523-27,301
5.	Caseworker (52304)	$17,478-26,030
	promotes to	
6.	Supervisor I (Welfare) (52311)	$21,523-30,074
7.	Tax Auditor (40521) (automatic $1,000 increase after 1 year of satisfactory service)	$19,402-25,342
	promotes to	
8.	Associate Tax Auditor (40522)	$23,922-33,282

mh

APPENDIX B

District Council 37, AFSCME, AFL-CIO

Testimony on

The Effects and Issues of Office Technology

Testimony Before the

New York City Council's Committee on Women

Miriam Friedlander, Chairperson

January 29, 1985

Deborah E. Bell, Assistant Director
Department of Research & Negotiations

Katherine Schrier, Administrator, Education Fund

District Council 37, AFSCME, AFL-CIO

I. District Council 37, AFSCME represents over 110,000 New York City municipal employees. We estimate that roughly 70,000 of them work in offices, in positions ranging from entry-level clerks to highly-skilled professionals. A large majority of these employees are female; over two-thirds of the employees D.C. 37 represents are female.

II. It is important to be clear about our definition of office automation. The use of mainframe computers and terminals linked to mainframes in New York City agencies is not office automation as we are discussing it today. The office automation that is occurring in New York City offices now is the outgrowth of the development of the microprocessor, a small and relatively inexpensive processing chip which has the capabilities of a room-sized computer of 25 years ago. The drastically reduced size and price of these chips has led to the proliferation of word processors and personal computers on desks everywhere -- hence the automation of information processing in offices.

New York City government offices have been late to be automated, in part, because the cost of investing in the equipment is still significant. In 1982, only a small number of word processors and personal computers were being used experimentally in some agencies. In the past two and a half years, there has been an explosion:

A. Over 900 employees covered by civil service filed for reclassification to the new Word Processor title, because they are performing word processing for a major portion of their work time;

B. Personal computers are being used in significant numbers by technical, professional and managerial employees in city agencies to perform a wide range of information-processing functions: planning, budgeting, even word processing.

III. The growing use of this equipment in New York City government offices and the changes in the content and organization of office work that accompany office automation raise a number of serious issues:

A. The need for new job titles and higher rates of pay arises because additional skills are often needed; employees may be asked to perform different and/or expanded duties and functions; and because New York City employees have a right to share in the City's gains from the increased productivity that using the equipment may bring.

B. The inevitable restructuring of office work using automated equipment will have effects ranging from simply more work getting done faster within an existing office structure to a complete reorganization of how information is processed in an office. Some of the changes are so significant that they may well result in an office environment we cannot fully imagine today. These effects raise the issue of the potential for job loss.

1. One aspect is the likelihood of the absolute elimination of jobs and certain jobs in particular:

    - Workforce reductions dating back to the fiscal crisis have resulted in paperwork backlogs in many agencies, so elimination of the backlog is often one of the first goals of an automated operation. Once the backlog has been processed, however, many agencies project job reductions, often through attrition, as part of their management plan or their rationale for purchasing the equipment.

- Another way that machines doing the work of people can lead to net job loss goes beyond volume to the substance of office work. Routine calculations, evaluations, and decision-making processes traditionally performed by professionals and managers can often be standardized and programmed into a personal computer, so that all a worker (often lower-paid than before) has to do is to input the relevant data, and the computer will produce a pre-formatted report presenting the results. In many industries, including government, this trend will have the effect of permanently eliminating significant numbers of higher-paying jobs -- what some analysts have characterized as "the disappearing middle." A stark example is that computer-assisted design (CAD) is expected to eliminate virtually all hand drafting work, which will mean the loss of 300,000 skilled, high-paying jobs nationally.

2. Another aspect of job loss that is of concern is the potential for a reduction in the number of full-time permanent civil service positions through the expanded use of part-time and temporary workers or through contracting-out of work. This is already

happening. Agencies' rationales include the need to find workers with skills City workers do not have or to get work done more cheaply. As we have discussed before this Committee previously, the City's commitment to training and upgrading its own workforce is far less than it should be, and D.C. 37 has demonstrated repeatedly that practices like contracting-out rarely save the taxpayers money and often undermine the efficiency of City agencies and the quality of City services.

C. Two issues which office automation raises must be seen as interrelated: career development and deskilling. Theoretically, acquiring the skills to use the new equipment should open doors to advancement as the skills are applied to more complex tasks, and, undoubtedly, many individual employees will try to take advantage of the opportunities. However, computer technology has produced very few new job categories -- word processing, computer programming and maintenance, and data-base management. In addition, there are structural barriers related to promotional opportunities. Although many of these barriers are not new, office automation has further stratified the office, so it is even more difficult for women to get out of the clerical ghetto. Often, the only title to promote to is a supervisory title, and there are far fewer supervisory positions than there are qualified employees to fill them. Usually, no bridges exist -- whether through training programs or transitional titles -- to title series performing other office functions. Therefore, a lot of jobs which initially appeared to offer wider opportunities because they involve working with automated equipment have proven to be dead-ended.

- An example from the mainframe data processing area are the Technical Support Aides, most of whom cannot pass the promotional exam to Computer Associate (Technical Support) because they have not had the necessary training or on-the-job experience with other aspects of the computer environment.

- The promotional route for Word Processors is to Principal Administrative Associate, which may or may not allow them to use their word processing skills and to which all the other clerical titles promote.

Opportunities must be created for City employees to build upon their skills and to transition to other occupational categories. The even more serious long-term question is whether there will be enough higher-skilled, higher-paying jobs for those able to fill them. The deskilling of office jobs through the clericalization of professional office functions, as described above, represents a serious threat to economic opportunity.

D. The issue of training and retraining will need much more attention than it has traditionally received if New York City government offices are to achieve positive productivity gains. A related issue concerns equitable procedures for selecting employees to be trained to use the new office equipment. At present, training on word processing equipment is often haphazard and varies from agency to agency. It is D.C. 37's position that there should be City-wide guidelines to ensure equity of access and minimum training standards. In addition, the City should be identifying and planning for retraining needs.

E. There are also safety and health and ergonomic issues relating to the use of automated office equipment which must not be ignored. The basic principle involved is to make the job fit the person not make the person fit the job. Among the issues are:

1. Stress, eye strain, back and neck strain, and circulation problems which arise from conditions like: insufficient work breaks, oppressive physical

layout, bad lighting, poor ventilation, unadjustable chairs and desk/table tops, and equipment without movable screens and keyboards. With regard to stress, individuals in high stress jobs such as those working on VDTs are often victims of anxiety, irritability, sleep disorders and fatigue. These symptoms can reduce worker morale and increase the absenteeism rate.

2. Radiation: There are many types of radiation. Studies have shown that the amount of ionized radiation emitted from VDTs does not exceed scientific and government standards. Studies of VDT emissions of non-ionized radiation, however, are not as conclusive, and more research is needed. As precautions, we recommend:

   - the installation of metal radiation shielding on all new VDTs; and

   - special precautionary measures be taken by pregnant women.

3. Beyond these general concerns, when you work in a New York City government office, there are other

kinds of basic safety concerns that office workers face, like ceilings falling in, faulty, exposed wiring, etc.

IV. What is D.C. 37 doing about these issues?

A. Educating our members through newspaper articles, conferences, education classes at the Union, and encouraging our members to get the skills they will need to perform in the office of the future.

B. In the arena of collective bargaining, D.C. 37 both has negotiated contract language that is relevant to office automation issues and, under the New York City Collective Bargaining Law, has the right to bargain with management concerning the practical impact of management's decisions concerning technology on bargainable terms and conditions of employment, like staffing, workload etc. For example, last year D.C. 37 negotiated with the City the establishment of a new title series for employees performing word processing. The Word Processor title has a higher minimum salary than the entry-level clerical title because of the expanded duties and functions, and there is automatic maturation to higher assignment levels based on experience with the equipment. The existing City-wide working conditions contract has language calling for adequate, clean, structurally safe and sanitary working conditions to be provided. The contract also establishes a joint labor/management City-wide occupational Safety and Health Committee to recommend policy to the Mayor. In the current negotiations for a successor agreement, D.C. 37 has made a number of demands on safety and health issues relating to office automation.

C. Joint labor/management committees like the Productivity Council and agency QWL Committees offer forums for raising and addressing some of these issues. For example, D.C. 37, the Office of Operations and the Department of Personnel have been working together on a survey of City agencies to ascertain current internal selection and training criteria for employees doing word processing.

D. D.C. 37 is also involved with other unions, including our parent organization, AFSCME, and other interested organizations in a variety of efforts to increase public awareness of the issues, particularly the pitfalls, created by office automation and to find solutions.

/mh

APPENDIX H

MAJOR FINDINGS CHART

Occupational Category	Type of Service Delivery	Employment Effects	Work Organization	Job Content	Training
CLERICAL & PARAPROFESSIONAL	Customized (DGS)	• some job loss through attrition. • increased work due to ↑ in demand for wp services. • potential clerical job loss due to professionals doing secy tasks.	• decentralized work process = more worker control. • work cluster organization. • increased integration of tasks.	↑ development of invisible skills. • ↑ abstract and conceptual skills • ↑ variety of tasks. • ↑ social relations skills	• Data processing Training Center. • Informal and cross-occupational training
	Production Style (HRA/Fin)	• staff reduction through attrition. • use of non-city employees (volunteer, co-op, workfare)	• ↑ work due to speed up & lack of supervision. • centralized work process, hence less worker participation. • work pool organization; increased stress, h&s problems; underpaid.	• professionalization of clerical work. • ↑ social skills to make system work.	• minimal training offered by vendors.
PROFESSIONAL & MANAGEMENT	Custom	• ↑ positions for staff analysts.	• ↑ work due to new databases. • ↓ workday for professionals. • greater power due to ↑ in data for particular units.	• clericalization of work within context of broadening skills. • enhanced content of work; high levels of job satisfaction.	• Training center with broad informal training.
	Production	• professionals taking on clerical tasks could result in downgrading.	• ↑ work due to ability system to generate more information. • prof. work redesigned to resemble paras. • system generates tedious procedures. • increase in fragmentation of work.	• clericalization of professional work in context of narrowing skill base; ie. less professional judgement required.	• Minimal training available.

APPENDIX I

DESCRIPTION OF STUDY TEAM

DR. JOAN GREENBAUM is the author of In The Name of Efficiency (Temple University Press, 1979), a path-breaking study of data processing workers in the United States. As a professor of computer science and economics, she frequently writes and lectures on the impact of technology on the labor process.

Greenbaum has just completed the first phase of an International Computer Labor Process Study with funding from the British Social Science Research Foundation. As the New York project director, she set up a study which interviewed both public and private managers to determine their strategies for the implementation of new technology.

CYDNEY PULLMAN and SHARON SZYMANSKI, are economists and labor educators with the Institute for Labor Education and Research. The Institute has ten years experience developing and facilitating research and education workshops for trade unions and national community-based organizations around the country. With major grants from the Department of Education (FIPSE) and NEH, the Institute has developed educational curricula and materials on a range of subjects for adult learners including: economics for working people, productivity and new technology workshops, the automobile and chemical industries, new approaches to grievance handling, quality of worklife, etc.

CYDNEY PULLMAN is co-director of the Institute and has done writing and research for many projects. She recently completely two pamphlets on the public sector in New York City and the automobile industry in New Jersey. Pullman has consulted with the Communications Workers of America (CWA, national union) to assist them in developing a major national program on the impact of new technology on work. She has lectured on economic and workplace issues to groups around the country and abroad.

SHARON SZYMANSKI heads the Women's Education Institute of the Labor Institute and has developed a major curriculum on family violence for shelters around the country. She has also contributed to Institute economics programs and materials and is currently producing a booklet on Economic Facts of Life for Women. Szymanski specializes in issues on women and the workforce focusing on occupational segregation and pay equity.

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Prepared for the
Office of Technology Assessment
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TABLE OF CONTENTS

Introduction.. i

I. Development of International Trade Policy ....p. 1
Creation of the Office of the Special Trade Representative.....p. 5

II. Functions of the United States Trade Representative....p. 8

III. Organization ....p. 11
Private Sector Advisory Committee...............p. 13

IV. Personnel and Budget.................................p. 16

V. Development of Office Automation......................p. 18
Into the Computer Age................................p. 18
Creation of the Trade Policy Information System.....p. 22
Introduction of Office Automation..................p. 30
Into Office Automation...............................p. 32
Electronic Mail......................................p. 34
Correspondence Control System.....................p. 37
Consolidation..p. 37
Training...p. 41
The Geneva Office....................................p. 46
Limitations..p. 47

VI. System Description...................................p. 49
Hardware...p. 49
Other Systems..p. 50
System Capabilities..................................p. 51

VII. Interviews..p. 61

VIII. Results..p. 64
Who Uses the System..................................p. 65
Time Saving..p. 68
Work Flow..p. 69
Additional Responsibilities..........................p. 71
Changes in Work Characteristics.....................p. 72
Changes in Personal Habits...........................p. 73
Changes in Personal Work Habits.....................p. 74
Job Satisfaction.....................................p. 74

IX. Agency Effects.......................................p. 75
Productivity...p. 75
Organizational Changes...............................p. 85

Appendix A, Interview Format

Appendix B, Detailed Interview Results

Chart 1, Trade Policy Committee Organization...............p. 10

Chart 2, USTR Organization...................................p. 12

Chart 3, Private Sector Advisory Committee Organization....p. 14

Chart 4, Agency Budget and Personnel Allocation............p. 17

Chart 5, Budget of USTR Computer Group.....................p. 33

Chart 6, Number of Items Sent/Received Via Electronic Mail.p. 36

INTRODUCTION

Development, introduction, and implementation of office automation at the Office of the United States Trade Representative has been unique in its approach and success in providing services to the agency. Because USTR is a small agency with wide ranging policy responsibilities, the capabilities it has been able to establish are extraordinary. Largerer government agencies undoubtedly have larger amounts of money with which to create their own automated office systems, but to this observer it appears that the Office of the United States Trade Reprsentative has made great strides in terms of coordination of system functions, training, effective use of funds, and efficient use of equipment than other agencies in the federal government.

To understand how and why office automation developed the way it did, this case study reviews the brief 25 year history of the office; its role in international trade policy; and early efforts to automate a number of functions to aid in carrying out its responsibiliites and how these early efforts served as the beginning of the present office automation system.

To evaluate the effectiveness of office automation to this point, a survey of agency staff was undertaken. The results, while not necessarily unexpected or dramatic in light of programs in a wide variety of organizations in the private and public sectors, do provide explicit indications of the types of personal and orgnizational changes that have occured since the introduction of office automation and provide points of departure for speculation of what might yet lie ahead as personnel become more familiar with the systems capabilities.

ACKNOWLEDGEMENTS

The author wishes to thank Barry Goldberg, Director of Computer Operations at the Office of The United States Trade Representative and Dennis Whitfield, Assistant United States Trade Representative for Administration for their support of this project; Meg Ricci of the Computer Operations staff for her valuable help; all the individuals who gave their time to discuss their experiences with the USTR system; and Maryann Madison and Vary Coates of the Office of Technology Assessment for their constructive comments.

SUMMARY

One of the more remarkable features of the USTR office automation system is that the ratio of terminals providing access to individuals is almost one-to-one. Research into office automation indicates that in most organizations this achievement is unique, at least at early stages of development. The ability of all levels of staff to access the system make it more highly utilized.

In the interview portion of this study, respondents indicated that they were in fact making extensive use of the equipment and its capabilities some saying they spent as much as 75% of their day using the machine in some way. Professionals in particular said they had come to rely on the ability to produce documents individually, without relying on secretarial support. Interview participants reported on average that work assignments and responsibilities could be completed 50% faster than without office automation which in turn enabled them to attend to a greater number of items than time would allow previously.

Utilization of the system by senior staff was the most notable exception. While many had access to the system, most made little use of its capabilities, suggesting that their responsibilities did not land themselves to functions offered by the integrated office automation system. This report suggests that the problem for senior staff may be partly do to their lack of experience with the system because of the small amount of writing that each does. Additionally, the report suggests that there is a need for senior staff to undergo a training program specifically designed to demonstrate how various aspects of their section responsibilities could be aided by the capabilities available.

The most useful training on use of the system, according to questionnaire responses, was provided by Computer Operations staff members. Responses indicate, however, that availability of a staff member for assistance was limited. Computer group staff have become increasingly occupied with system maintenance and expansion, limiting the amount of time available for user assistance.

Organizational changes as a result of office automation have occurred mainly in the relationship between professional and secretarial staff. Those secretaries who work with professionals that rely on office automation find themselves with much less typing. More and more they screen phone calls or attempt to help professionals with on-going work. In some cases reduced reponsibility and idleness have resulted in a loss of job satisfaction. In other cases, secretarial staff have found themselv much more satisfied as a result of reduced stress and the ability to do different types of work in their particular section. The lack of advancement opportunities, however, for those who feel they are underutilized may lead to dissatisfaction and greater turnover. This study suggests too that senior staff eventually may be able to carry out their responsibilities with less professional staff as they become more familiar and comfortable with the system.

Finally, responses from the questionnaire indicate that all staff members of the agency believe that office automation has increased the efficiency and effectiveness of the organization in carrying out its responsibilities in the United States international trade policy community. All agreed that office automation has made USTR faster to respond than counterparts to policy initiatives or problem areas. Respondents also believe that office automation has given the agency a greater amount of respect in the business community it serves.

DEVELOPMENT OF INTERNATIONAL TRADE POLICY

While seemingly arcane to most Americans, creation and conduct of policies concerning foreign trade and commerce is one of the most important responsibilities of the Federal Government. The significance of trade policy dates back to the founding of the country when declarations against taxation without representation included bans against levying tariffs on goods from other countries. Throughout the Revolutionary War, the Continental Congress was denied the power to levy taxes or tariffs to raise money for its conduct and was forced to depend instead upon voluntary contributions from the States.

In 1787, the drafters of the Constitution, in response to the growing need for funds, delegated to the federal government the "power to lay and collect taxes" and to regulate interstate and foreign commerce. Congress played the primary role in formulati U.S. foreign trade policy from that time until 1934. During this 145-year period, tariffs were the primary trade issue addresse in nine major tariff revisions to meet changing economic conditions both in the United States and around the world. The major role of the Executive Branch was the administration and collection of tariff revenues.

World War One served as the turning point for modern trade agreements between countries. Dramatically, the world had grown smaller, more interdependent. Countries, peoples, and economies became as concerned about economic conditions of others as they were of their own. In the aftermath of the war, the view of the United States on international trade - which had been been to protect American markets and products from foreign competition- changed markedly. As the United States became a prime producer of goods for a recovering European continent, the justification for traditionally high protective tariffs for U.S. goods lessened. But a period of nationalism and isolationism followed the end of the war in the belief that the country should become more self suffcient and avoid further foreign "expeditions".

This surge of protectionist sentiment led to the passage of the Smoot-Hawley Tariff Act of 1930, which established the highest tariffs in United States history. These policies triggered retaliatory actions of tariff increases around the world. As more and more nations joined in raising tariff and other trade barriers against U.S. exports, a world wide depression ensued, eroding the economic and industrial bases on which world trade depended.

The experience of the Smoot-Hawley Act and the world wide depression influenced Congress to adopt a new approach to trade. Congress enacted the Reciprocal Trade Agreements Program proposed by Franklin Roosevelt in 1934, reserving for itself less direct responsibility and involvement in the conduct of foreign trade policy.

An amendment to the Smoot-Hawley Act, the Reciprocal Trade Agreements Act authorized the President to lower duties in trade agreements with foreign countries and adopted the principle that tariff adjustments be made on a selective and reciprocal basis.

Maintaining its basic constitutional power, Congress retained control and oversight of actions of the Executive Branch by (1) placing specific limitations on the extent of permissable tariff reductions, and (2) by setting an expiration date on the negotiating authority. The latter provision, allowing Congress the opportunity to withdraw, continue, or modify this authority, also provides Congress with a powerful influence over the capacity of the Executive Branch to formulate and implement trade policy.[1]

This "merger" of constitutional authority of the Congress to raise revenue and regulate foreign commerce, and the President's authority to make treaties with the advice and consent of the Senate was unique at the time. The enactment of the war powers act in 1965 was to be another example of Congress granting the executive greater flexibility in matters originally reserved to itself.

Initially, the law provided that before concluding a trade agreement, "the President shall seek information and advice with respect thereto from the United States Tariff Commission, the Departments of State, Agriculture, and Commerce and from such other sources as he may deem appropriate." The purpose of this provision was to ensure a balanced approach to tariff adjustments.[2] Pursuant to the Trade Agreements Act of 1934 and an Executive organization order, a Trade Agreements Committee was established. The Committee was orginally composed of eight agencies: The Department of State, Agriculture, Commerce, and Treasury, the Tariff Commission (now the International Trade Commission), the Agricultural Adjustment Administration, the National Recovery Administration, and the Office of the Special Advisor to the President on Foreign Trade. The primary function of the Trade Agreements Committee was to pool interagency information and to coordinate activities and responsibilities under the Trade Agreements Acts so as to provide a coherent and balanced trade policy. The committee was chaired by the Secretary of State. As a result, between 1934 and 1962, the Department of State was primarily responsible for administering the Reciprocal Trade Agreements Act and for trade policy in the conduct of multilateral and bilateral trade negotiations. This committee approach to organizing the views of all agencies with interest in foreign trade policy, with some variation, is still in use today.

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[1] "Executive Branch Organization to Formulate and Implement U.S. Foreign Trade and Investment Policy", Raymond Ahearn and David Driscoll, Library of Congress, Congressional Research Service, Report No. 81-193E, August 25, 1981, p 6.

During the late fifties and early sixties, both Congressional and private sector dissatisfaction with the State Department's conduct of trade negotiations prompted the Congress to reorganize Executive Branch trade responsibilities.

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[2] A Preface to Trade, Executive Office of the President, United States Trade Representative, Washington, D.C., September, 1982, p 79.

Creation of the Office of Special Trade Representative

As a part of the Trade Expansion Act of 1962, Congress authoriz the appointment of a Special Representative for Trade Negotiations (STR) as chief negotiator for the United States. The position was created primarily in response to complaints from the private sector (particularly agriculture) that the State Department emphasized foreign policy matters and neglected domestic economic and political interests.[3] A 1963 Executive Order established the Office of the Special Trade Representative, and provided for the appointment of two Deputy Representatives for Trade Negotiations. The act of 1962 also established an interagency trade organization patterned after the interagency process established to assist the President in carrying out his trade responsibilities by the 1934 act. This Executive Branch organizati functioned through "the Kennedy Round",[4] of multilateral trade negotiations held from 1962 to 1967.

In 1969, after the change of administration, the role of the Office of the STR was reduced considerably. Control of foreign trade policy was viewed by the new administration as the responsibility of the Executive Branch and was moved within the White House under direct control of the President and his advisors. The Department of Commerce was charged with greater responsibility for compilation of trade data to support White House policy makers.

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[3] Ahearn and Driscoll, op. cit., p 6.

[4] The popular name for the sixth "Round" of trade negotiations under the aegis of the General Agreement on Trade and Tariffs (GATT) held from 1963 to 1967, the Kennedy Round produced major cuts in tariffs, an "antidumping code," and a short-lived international wheat agreement. The GATT, a multilateral agreement which became effective in 1948, is subscribed to by 87 governments which together account for more than four-fifths of world trade. GATT's rules govern the trade of its member countries and the conduct of their trade relations with one another. The designation, GATT, also refers to the organization's headquarters in Geneva through which the Agreement is enforced. The organization provides a framework within which international trade negotiations are conducted and trade disputes resolved.

The passage of the Trade Act of 1974 strengthened the Office of the Special Trade Representative by authorizing U.S. participation in a new round of multilateral trade negotiations, known as "The Tokyo Round",[5] and elevating the position of Special Trade Representaive from subcabinet to cabinet level. The act also provided a statutory basis for the office within the Executive Office of the President. The Office was charged with the administration of the Trade Agreements Program under the Tariff Act of 1930, the Trade Expansion Act of 1962, and the Trade Act of 1974.

Executive Branch Reorganization Plan No. 3 of 1979, implemented by Executive Order of January 4, 1980, renamed the Office of the Special Trade Representative, the Office of the United States

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[5] This round of negotiations, the seventh such meeting held under the GATT, became known as "The Tokyo Round" or the "Multilateral Trade Negotiations" (MTN). The negotiations were formally intiated by the 1973 Tokyo Declaration and differed from previous negotiations held under the General Agreement of Tariffs and Trade in that more countries were involved including many developing countries and several Eastern European countries. Greater efforts were made to eliminate, reduce, or discipline non-tariff measures that restrict trade as well as tariffs, especially with respect to impediments to the expansion of international trade in agricultural goods. The Tokyo Round began in 1976 and was completed in 1979.

Trade Representative (USTR) and assigned USTR overall responsibili for formulating and coordinating United States foreign trade policy. More specifically, the Plan provided the USTR with "the lead role for representing the United States on trade matters abroad and for developing and coordinating the effective implementation of U.S. trade policy." The Plan charged the USTR with responsibility for representing the United States in all trade negotiations regarding GATT matters, East-West trade, internationa investment, commodity agreements, and matters considered by the Organization for Economic Cooperation and Development (OECD) and the United Nations Conference on Trade and Development (UNCTAD The plan made the USTR the principal advisor to the President on international trade policy.

A proposal made in 1984 may yet again reorganize U.S. trade policy. The President, with strong support from the Secretary of Commerce, proposed to Congress the creation of a Department of International Trade and Industry which would consolidate government policy toward industrial and agricultural production as well as assume control of international trade policy and replace the Department of Commerce. The proposal would place the Office of the United States Trade Representative under direct control of the Secretary of the new department. While the proposal did not win acceptance of Congress, the President has promised to raise it again in 1985.

FUNCTIONS OF THE UNITED STATES TRADE REPRESENTAIVE

The United States Trade Representative chairs the Cabinet-leval Trade Policy Committee. Established by, and under the chairmanship of the Office of the United States Trade Representative are three other interagency committees - the Trade Negotiations Committee, the Trade Policy Review Group, and the Trade Policy Staff Committee. (See chart # 1).

With the advice of the interagency Trade Policy Committee (TPC) and its subordinate bodies, USTR has primary repsonsibility for devloping international trade policy, coordinating its implementation and conducting international trade negotiations. The USTR, with the advice of the Committee, is responsible for policy guidance on issues arising in the exercise of international trade functions including the following:

1) expansion of U.S. exports;
2) matters concerning the General Agreement on Tariffs and Trade (GATT), including implementation of agreements negotiated in the MTN, U.S. Government positions on trade and commodity matters dealing with multilateral organizations, and the protection of U.S. rights under international trade and commodity agreements;
3) to the extent permitted by law, overall U.S. policy with regard to unfair trade practices, including enforcement of countervailing measures and antidumping functions;
4) bilateral trade and commodity issues, including East-West trade matters;

5) international trade issues involving energy;

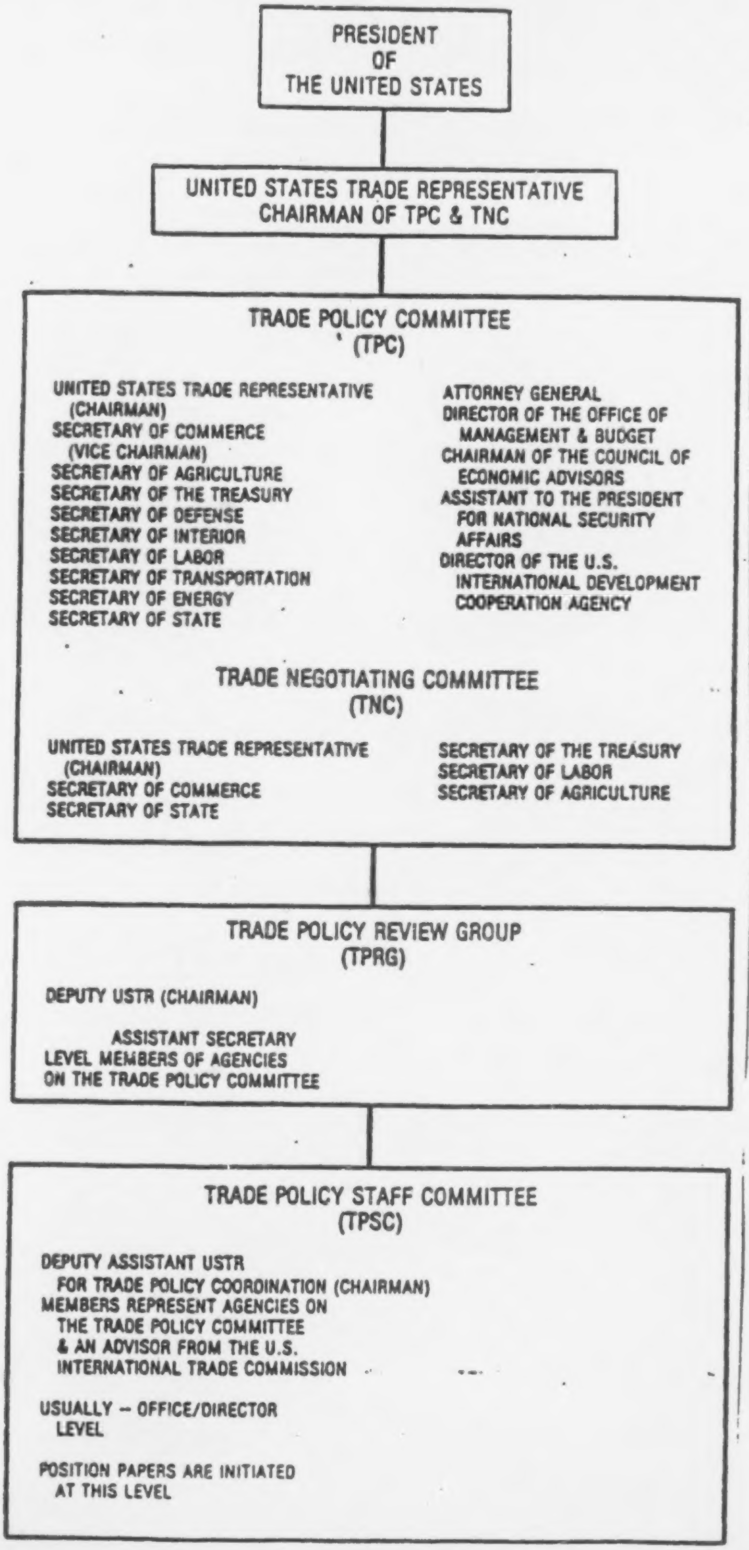
6) direct investment matters to the extant they are trade related;

7) policy research on international trade, commodities and direct investment matters.

Under the reorganization of 1980, the USTR became Vice Chairman of the Overseas Private Investment Corporation (OPIC), a nonvoting member of the Export-Import Bank, and a member of the National Advisory Committee on International Monetary and Fiancial Policies.

CHART 1

U.S.
INTERNATIONAL TRADE POLICY INTERAGENCY COORDINATION



PRESIDENT
OF
THE UNITED STATES

UNITED STATES TRADE REPRESENTATIVE
CHAIRMAN OF TPC & TNC

TRADE POLICY COMMITTEE
(TPC)

UNITED STATES TRADE REPRESENTATIVE (CHAIRMAN)
SECRETARY OF COMMERCE (VICE CHAIRMAN)
SECRETARY OF AGRICULTURE
SECRETARY OF THE TREASURY
SECRETARY OF DEFENSE
SECRETARY OF INTERIOR
SECRETARY OF LABOR
SECRETARY OF TRANSPORTATION
SECRETARY OF ENERGY
SECRETARY OF STATE
ATTORNEY GENERAL
DIRECTOR OF THE OFFICE OF MANAGEMENT & BUDGET
CHAIRMAN OF THE COUNCIL OF ECONOMIC ADVISORS
ASSISTANT TO THE PRESIDENT FOR NATIONAL SECURITY AFFAIRS
DIRECTOR OF THE U.S. INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

TRADE NEGOTIATING COMMITTEE
(TNC)

UNITED STATES TRADE REPRESENTATIVE (CHAIRMAN)
SECRETARY OF COMMERCE
SECRETARY OF STATE
SECRETARY OF THE TREASURY
SECRETARY OF LABOR
SECRETARY OF AGRICULTURE

TRADE POLICY REVIEW GROUP
(TPRG)

DEPUTY USTR (CHAIRMAN)

ASSISTANT SECRETARY LEVEL MEMBERS OF AGENCIES ON THE TRADE POLICY COMMITTEE

TRADE POLICY STAFF COMMITTEE
(TPSC)

DEPUTY ASSISTANT USTR FOR TRADE POLICY COORDINATION (CHAIRMAN)
MEMBERS REPRESENT AGENCIES ON THE TRADE POLICY COMMITTEE & AN ADVISOR FROM THE U.S. INTERNATIONAL TRADE COMMISSION

USUALLY -- OFFICE/DIRECTOR LEVEL

POSITION PAPERS ARE INITIATED AT THIS LEVEL

ORGANIZATION

Assisting the USTR with his repsonsibilities for trade negotiatio are three Deputy Urited States Trade Representatives who also hold the rank of ambassador, two in Washington and one in Geneva, Switzerland. The Deputy USTR in Geneva is the U.S. representative to the GATT and is also responsible for negotiations regarding trade and commodities under UNCTAD. The Deputies in Washington are resposnible for trade policy coordination and negotiations outside GATT and UNCTAD. In addition, the Chief Textile Negotiator (also holding ambassadorial rank) has primary responsibility for negotiations of textile agreements and represents the United States Government in dealing with foreign governments in all matters relating to textile tariffs and non-tariff measures.

The USTR is further assisted by the General Counsel and the Assistant USTR for Administration who supervises the Directors of Management, Computer Operations, Congressional Affairs, Public and Intergovernmental Affairs, and Private Sector Liason.

There are also Assistant U.S. Trade Representatives in the following areas: Trade Policy Development and Coordination; Industrial and Energy Policy; International Investment Policy; Agriculture and Commodities; GATT Affairs; Europe and Japan; the Americas; the Pacific, Asia, Africa, and North/South Trade; and Non-Market Economies and East-West Trade.[6]

(See Chart # 2).

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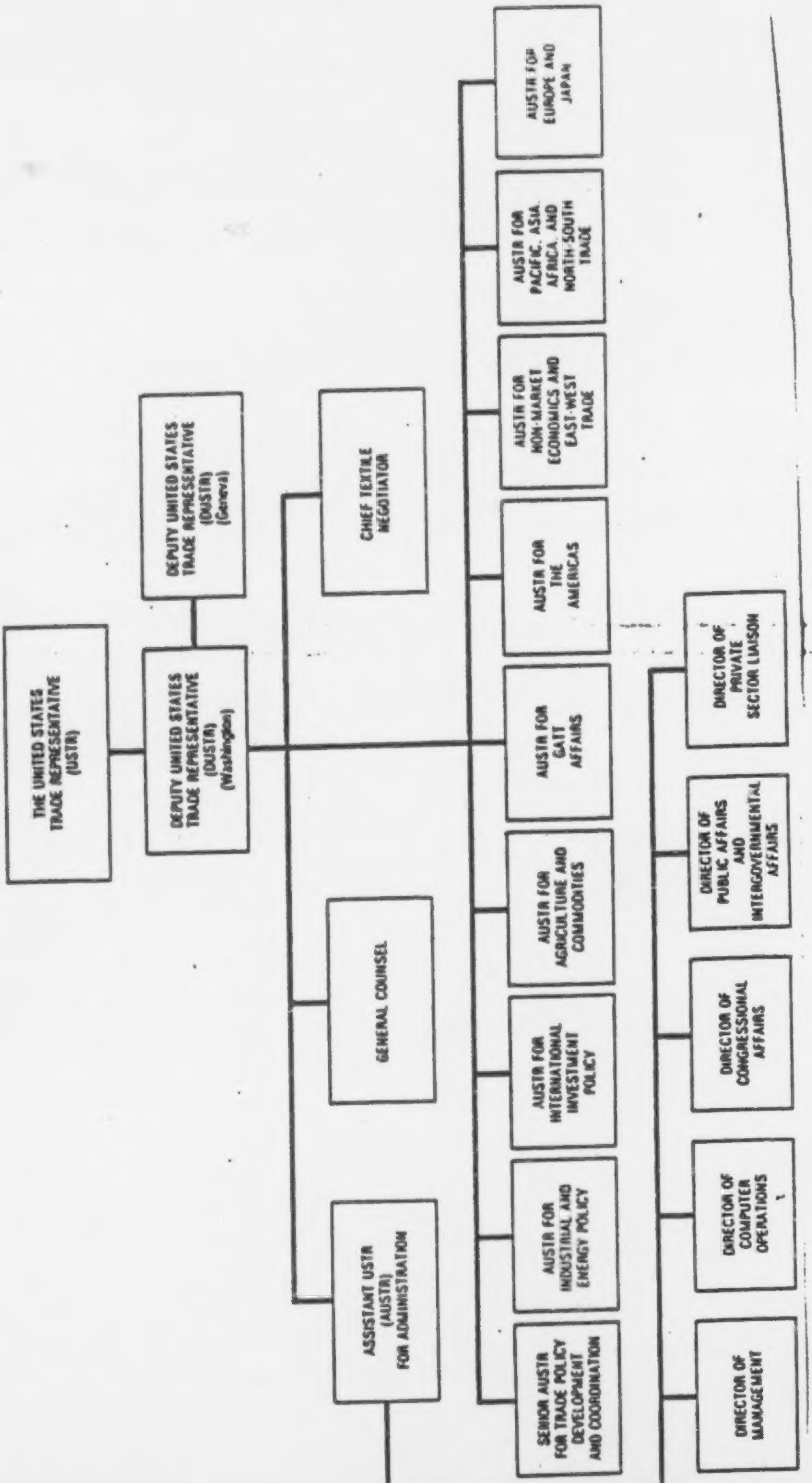
[6] _A Preface to Trade,_ Op. Cit., pp. 23-24.

Chart 2

OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE
EXECUTIVE OFFICE OF THE PRESIDENT

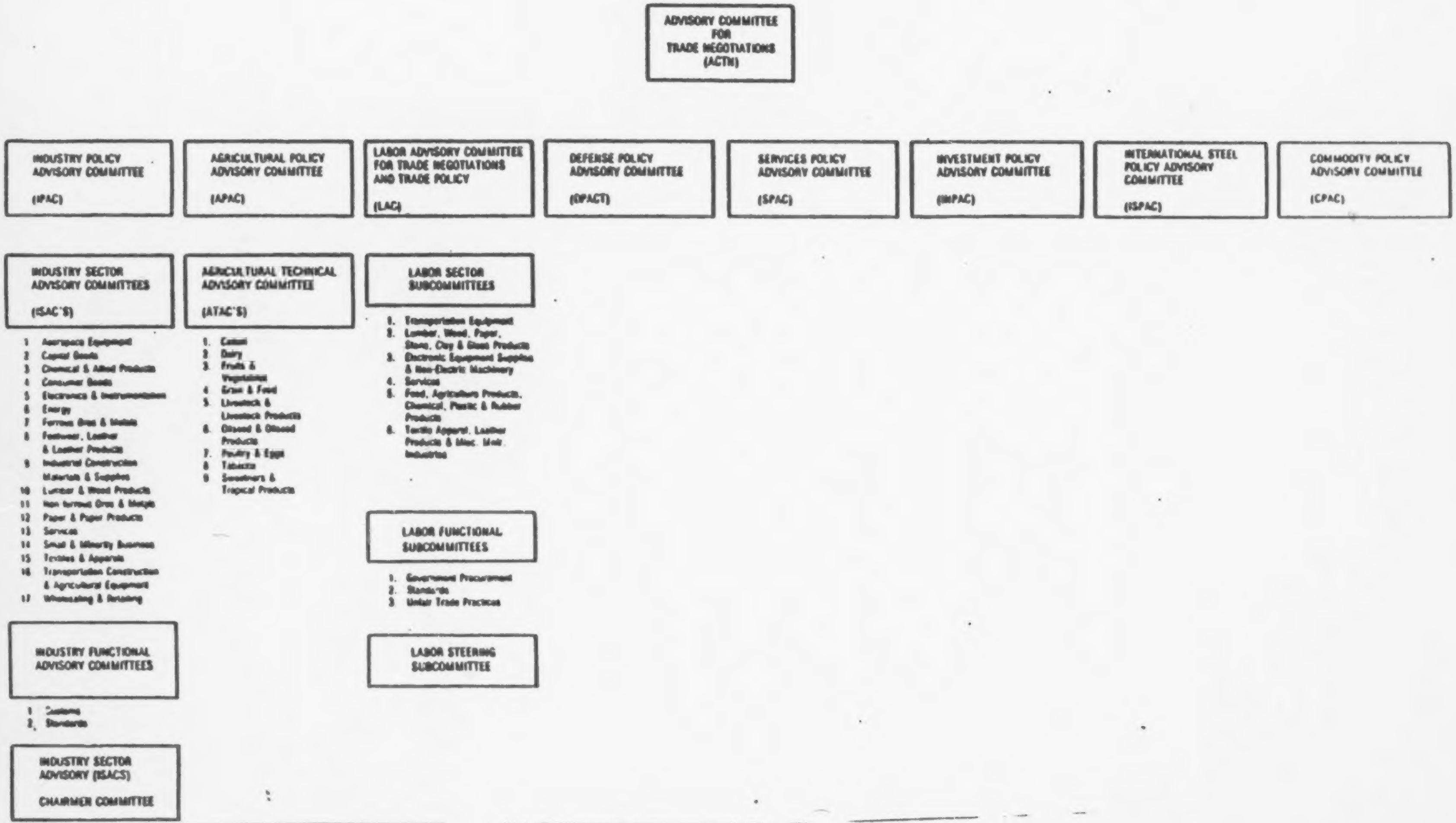

THE UNITED STATES TRADE REPRESENTATIVE (USTR)
DEPUTY UNITED STATES TRADE REPRESENTATIVE (DUSTR) (Geneva)
DEPUTY UNITED STATES TRADE REPRESENTATIVE (DUSTR) (Washington)
ASSISTANT USTR (AUSTR) FOR ADMINISTRATION
GENERAL COUNSEL
CHIEF TEXTILE NEGOTIATOR
SENIOR AUSTR FOR TRADE POLICY DEVELOPMENT AND COORDINATION
AUSTR FOR INDUSTRIAL AND ENERGY POLICY
AUSTR FOR INTERNATIONAL INVESTMENT POLICY
AUSTR FOR AGRICULTURE AND COMMODITIES
AUSTR FOR GATT AFFAIRS
AUSTR FOR THE AMERICAS
AUSTR FOR NON-MARKET ECONOMICS AND EAST-WEST TRADE
AUSTR FOR PACIFIC, ASIA, AFRICA, AND NORTH-SOUTH TRADE
AUSTR FOR EUROPE AND JAPAN
DIRECTOR OF MANAGEMENT
DIRECTOR OF COMPUTER OPERATIONS
DIRECTOR OF CONGRESSIONAL AFFAIRS
DIRECTOR OF PUBLIC AFFAIRS AND INTERGOVERNMENTAL AFFAIRS
DIRECTOR OF PRIVATE SECTOR LIAISON

Private Sector Advisory Committee

In addition to the Trade Policy Committee structure mandated by law to coordinate government policy on foreign trade matters, USTR is also responsible for managing the Advisory Committee for Trade Negotiations. The Trade Act of 1974 provided for the establishment of a system of private sector advisory committees to ensure that a formal mechanism existed to maintain a continuous dialogue between government and the private sector, regarding trade agreements. (See chart # 3)

CHART 3

OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE
ADVISORY COMMITTEE SYSTEM


ADVISORY COMMITTEE FOR TRADE NEGOTIATIONS (ACTN)
INDUSTRY POLICY ADVISORY COMMITTEE (IPAC)
AGRICULTURAL POLICY ADVISORY COMMITTEE (APAC)
LABOR ADVISORY COMMITTEE FOR TRADE NEGOTIATIONS AND TRADE POLICY (LAC)
DEFENSE POLICY ADVISORY COMMITTEE (DPACT)
SERVICES POLICY ADVISORY COMMITTEE (SPAC)
INVESTMENT POLICY ADVISORY COMMITTEE (INPAC)
INTERNATIONAL STEEL POLICY ADVISORY COMMITTEE (ISPAC)
COMMODITY POLICY ADVISORY COMMITTEE (CPAC)
INDUSTRY SECTOR ADVISORY COMMITTEES (ISAC'S)
1 Aerospace Equipment
2 Capital Goods
3 Chemical & Allied Products
4 Consumer Goods
5 Electronics & Instrumentation
6 Energy
7 Ferrous Ores & Metals
8 Footwear, Leather & Leather Products
9 Industrial Construction Materials & Supplies
10 Lumber & Wood Products
11 Non ferrous Ores & Metals
12 Paper & Paper Products
13 Services
14 Small & Minority Business
15 Textiles & Apparels
16 Transportation Construction & Agricultural Equipment
17 Wholesaling & Retailing
AGRICULTURAL TECHNICAL ADVISORY COMMITTEE (ATAC'S)
1. Cotton
2 Dairy
3. Fruits & Vegetables
4 Grain & Feed
5. Livestock & Livestock Products
6. Oilseed & Oilseed Products
7. Poultry & Eggs
8 Tobacco
9 Sweeteners & Tropical Products
LABOR SECTOR SUBCOMMITTEES
1. Transportation Equipment
2. Lumber, Wood, Paper, Stone, Clay & Glass Products
3. Electronic Equipment Supplies & Non-Electric Machinery
4. Services
5. Food, Agriculture Products, Chemical, Plastic & Rubber Products
6. Textile Apparel, Leather Products & Misc. Mfr. Industries
LABOR FUNCTIONAL SUBCOMMITTEES
1. Government Procurement
2. Standards
3 Unfair Trade Practices
LABOR STEERING SUBCOMMITTEE
INDUSTRY FUNCTIONAL ADVISORY COMMITTEES
1 Customs
2. Standards
INDUSTRY SECTOR ADVISORY (ISACS) CHAIRMEN COMMITTEE

The efforts of the advisory committee in aiding passage of the Trade Agreements Act of 1979 and in assisting the reorganization of trade policy functions were recognized by Congress which provided for continuation of the program in the Trade Act of 1979. The responsibilities of the committees have been expanded beyond providing negotiating advice on trade agreements to the priorities and direction of U.S. trade policy.

The advisory committee system is managed by USTR in cooperation with the Departments of Commerce, Agriculture, Labor, and Defense. The committees fall into three categories. At the top of the system is the Advisory Committee for Trade Negotiations. Each of its forty five members are appointed by the President and represent various elements of the economy with interests in international trade.

The second level of committees are policy advisory committees in specific areas of industry, agriculture, labor, defense, services, investments, steel, and commodities. They advise the government on how trade issues affect their respective areas.

At the third level are technical and sectorial committees made up of experts in particular fields. These committees offer specific examples and technical information relating to problems in the private sector affected by trade policy. Members of the policy advisory committees and the technical and sectorial advisory committees are appointed jointly by the USTR and the Secretary of the relevant department.

PERSONNEL AND BUDGET

The Office of the Special Trade Representative began operation in 1963, with its first full budget authority for the fiscal year 1964 of $435,000 and a staff of twenty nine. The staff size remained relatively stable until 1972 when it began to increase.

By 1980, after the Office had been reorganized and charged with expanded responsibilities, the number of permanent full time staff had grown to 116 plus ten Assistant United States Trade Representatives, bringing the number to approximately 126.[7] By 1984 the budget was $11.3 million dollars. The permanent staff was 122, while total staff, including personnel from other agencies, contractors and part-time personnel brought the total number of individuals working at USTR to 183.
(See Chart# 4).

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[7] The exact number of agency employees and their functions for each year is unavailable other than the totals of full time permanent positions alloted according to the Budget of the United States Government for each year. Detailing employees to the Executive Office of the President has become a common practice and certainly some detailees were at USTR in earlier years. Enabling legislation and budget authority for the Office also allows specifically "For expenses necessary for the Office of the (STR) USTR, including...the employment of experts and consultants as authorized by 5 U.S.C. 3109."

Chart 4

Fiscal Year	Thousands of $	Allocated Permanent Full-Time Positions
1964	430	
1965	540	29
1966	567	28
1967	566	28
1968	566	28
1969	742	37
1970	625	33
1971	757	35
1972	930	42
1973	1,138	46
1974	1,136	45
1975	1,925	45
1976	2,000	45
1977	2,370	49
1978	2,560	49
1979	2,665	41
1980	8,418	116
1981	9,271	116
1982	9,000	113
1983	10,100	113
1984	11,647	113
1985(est)	14,179	122

Source: Budget of the United States Government, 1962-1984, U.S. Government Printing Office, Washington, D.C.

DEVELOPMENT OF OFFICE AUTOMATION

Into the Computer Age

Developments or breakthroughs in most endeavors rarely emerge as fully operational programs. Change is usually preceeded by other events which come together to produce desired or unexpected results. In the case of the development of office automation at the Office of the United States Trade Representative, there appear to be three particular events that contributed most significantly: 1) commitment by the United States to a new round of multilateral negotiations and the need for a method to handle large volumes of trade data and material, 2) failure of the Department of Commerce to assume a leading role in the creation of a centralized trade data base, and 3) the introduction of small, personal computers into the work place.

Commitment of the United States to the Kennedy Round of negotiations held from 1963 to 1967, were the first in which the Special Trade Representative played an active and leading role. To prepare for these negotiations, the Office of the STR realized an essential task would be to consolidate a large amount of information and trade data that reflected activity in a wide variety of materials and goods being traded in order to determine the relative position of all the parties to the negotiations. It would, among other things, be necessary to review the large number of items with tariff restrictions, the rate on each, and the reason for such treatment in order to compare relative treatment and discover points for negotiation.

Computer technology and capability, plus the increased use of computers in government at the time, suggested to STR staff that some computerized data base could be developed specifically for international trade to aid in the negotiations. Data existed in a number of files in many different agencies with responsibility or interest in international trade.

Data describing such basic indicators as trade volumes, tariff rates, or items restricted often differed depending on which agency of government kept figures or how figures were reported. The was no centralized data base within the U.S. international trade community to provide a clear picture of the impacts or effects of U.S. policies or those of foreign countries on the U.S. Coordination of trade policy was also difficult as a result, especially as trade among countries had increased so dramatically in the late fifties and early sixties.

Of great importance too in that period, was the need for a consolidated base of accurate information on a macro scale. Understanding trade issues required that U.S. negotiators have a clear picture of multilateral and bilateral trade balances between and among countries. Like data about goods and materials, (services would be included in the Tokyo Round of negotiations) no one agency involved in international trade issues had all of the relevant information in one place. So the Office of STR began efforts to consolidate trade information focusing the effort on the development of a shared interagency data base.

Documentation of the discussions and decisions which led to programs to automate trade data are fairly scarce, primarily because the individuals involved in the early effort have since left the agency and precise records were not kept. Those files that were available contain documents which give some insight into the discussions taking place at that time.

An agency memorandum dated September, 1966, titled "Our Project" suggests what early steps were being taken to develop some sort of data processing capacity:

> The computers at long, long last have begun to spew out some reasonably accurate data....

it also outlines what types of products the agency should expect as the program progressed:

> What we have (so far) are the tidbits of (the) offers balance--bilateral and multilateral, and very shortly by sectors, BTN chapters (Brussels Tariff Nomenclature)....we have yet to go far into stage two which is the net effect on the U.S. trade balance, statistically and dynamically.... ....we shall, of course, be able to examine in much greater depth the bilateral and sector problems, point out areas in each for maximum effort at further offers and for most effective withdrawls.
>
> ...we now also have the capability of testing our assumptions...
>
> Finally, we should soon be in a position to make quick comparisons with the various types of traditional accounting for balances and reciprocity.
>
> There is still a lot that the machine and our thin line of troops can't do very easily. We'll have a hard time bringing into the picture the qualitative aspects such as the significance of what is not being offered, or the significance of the height of post-concession duties.

A problem had also developed between the Washington office and the Geneva office over data used as a basis for negotiation.

Alluded to in the same September, 1966 memo, it was the need for the Geneva office, essentially the front line negotiating office for GATT, to keep the Washington office up to date on data it was using to make decisions on negotiating positions. The Geneva office, being geographically removed from the data collection effort in Washington, relied on its own data collected from sources in Europe and from other U.S. Government agencies. letter from a member of the Washington office of STR to a member of the negotiating team in Geneva in July, 1966 hints at the need to coordinate the use of data:

> We have been holding some informal interagency discussions concerning the desirability of building a data bank containi trade and tariff information of all countries. One purpose is to provide a data source for detailed LDC (less developed countries) trade analysis in relation to the trade preferenc question. But more generally, there is interest in having all the data the U.S. possesses or can acquire regarding other countries in one place.
>
> Clearly this is a big task, if data from various sources are to be made comparable. As a first step, we would like to make a comprehensive inventory of data presently in the hands of the U.S. Government. In accord with the wishes of Commerce, State, the Tariff Commission (now the Internati Trade Commission (ed.), and STR, I am therefore writing to you to request that you prepare for us a list of all the countries for which you have updated trade and tariff data in Geneva above and beyond that which was done here at STR noting also that which you expect to acquire in the near future.

This problem was mentioned by one of the present USTR senior staff members in the interview portion of this study as one that was important to rectify through some sort of consolidated data base. Very often the Geneva office would be conducting negotiations involving positions determined by data available to it without consideration by STR staff in Washington.

Initial efforts by STR to centralize trade data were undertaken using contracted computer and programming time. Monetary support for the effort, was contained in a special appropriation in the budget for the years 1967, 1968, and 1969, of one hundred seventy five thousand dollars, "For statistical and computer support of the GATT negotiations...This program started in 1964, provided the U.S. with necessary information for the major 6th round of negotiations (the Kennedy round) in Geneva under the GATT which ended June 30, 1967. 1969 funds will be used to perform computer support for studies of current and future trade policy issues."[8]

Creation of the Trade Policy Information System

The second event that would have a major influence on development of office automation at STR occurred as the effort to centralize trade data and the policy making role in international trade moved from STR to the Commerce Department. As mentioned above, the Nixon administration established control of international trade policy in the White House, relying on the Commerce Department for assistance. Commerce at that point had the opportunity to take control of the trade data base, and possibly policy initiatives as well. Commerce, however, made no vigorous attempt to expand the program. Meanwhile, the project was kept alive at STR by encouraging the Commerce Department to act.

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[8] The Budget of the United States Government, Appendix, 1969, p. 62

By 1974, a new trade act was passed renewing and expanding the role and responsibility of STR. The Tokyo Round, which had been agreed to in 1972 and was set to begin in Geneva in 1976, renewed impetus for STR to pursue the computerization/centralization program.

If the Commerce Department had chosen to take control of the consolidation of foreign trade data, it is possible that office automation at STR would not have evolved as it did, at least not on the same schedule.

An internal agency memo of March, 1974 suggests efforts were being made to devlop a system to accomodate all of the data that STR staff felt was required to study trade issues as well as aid in the conduct of the upcoming negotiations, by outlining a plan utilizing the hardware and programming capability of the Central Intelligence Agency. Essentially the plan expanded on earlier efforts of STR staff to capture relevant trade data as well as adding arithmetic and algebraic functions, and formatt and unformatted outputs.

The CIA submitted a proposal to STR in June, 1974, to build such a system utilizing a program called General Information Management (GIM). The proposal called for the CIA group to progra and load selected trade data[9] into the GIM system which would later be transfered to another computer system outside the CIA.

The CIA proposal included the development of communications capability between the STR Washington and Geneva offices by high speed data link requiring a computer at both locations tied together for real time access. The proposal noted that bit error rates would be low and security good because transmission software was changed regularly. This would be the first of a number of efforts to electronically link the STR Geneva office to the Washington office. But, the report noted that such a system would be inadequate for the transmission of information classified as secret or above.

In 1975, STR hired several consultants to assist in building and maintianing capabilites begun by this proposal. It was at this time that the "Computer Group" at STR became officially recognized.

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[9] Data to be installed on the system included: GATT import data for 11 countries or country groups for the years 1970 and 1971 (1972 when available), by country of origin, in value, and in country where reported; CIF (valuation system of imports that includes all costs, insurance, and freight involved in shipping goods from their port of embarkation to destination) adjustment factors for the United States, Canada, and Australia; TSUSA-TSUS (Tariff Schedules of the United States, Annotated - Tariff Schedules of the United States) consolidation of U.S. imports for 1970-1973; Schedule B export data for 1970-1973 by country of destination, in value and in quantity where available at the seven digit level; concordances necessary for comparisons under alternative nomencaltures; additional tariff line information for the United States and other countries where available; and backgroun data required for analytical routines such as exchange rates, price deflators, and elasticitites.
"Project Proposal for STR Centralized Data Base", June 20, 1974, memorandum to Ambassador William D. Eberle, Office of the Special Trade Representative, from Maurice C. Ernst, Director, Economic Research, Central Intelligence Agency, Washinton, D.C.

The program developed by the CIA using GIM was eventually transfered to the Department of Commerce computer facility and to a computer system at the National Institute of Health. An STR staff memo of April, 1976, describes how the capabilities of the system had developed to that point:

> The computer hardware system of STR's centralized trade and information data base consists of two computer systems located off the premises, and a variety of computer accessori located at STR which provide direct, quick contact with the systems. The systems are:
>
> 1. IBM 370, located at NIH, utilized for batch processing via telecommunication interface equipment. Besides remote batch processing, the 370 series also functions as a word processo (Wylbur). In this capacity it assists the STR staff in preparing and editing reports, briefs, letters, etc.
>
> 2. The IBM 360/365, located at the Department of Commerce, utilized for on-line processing (the GIM system).

To enable STR to communicate with the systems containing the GIM data, STR acquired CRT's and a minicomputer which would be the beginning of the STR's hardware acquisitions:

> ...the STR hardware system (consists of) three delta data series 5000 terminals (CRT). Each of these video display units have the capacity to commuincate with both the GIM system located at Commerce, and the DCRT batch processing located at NIH.
>
> Also located at STR, is a mini-computer -- the Data General Nova II computer. It is currently used to communicate with the GIM system at Commerce. Eventually it will be utilized as an in-house word processor -- performing a function similar to the one currently done by the "Wylbur" system at NIH.

It was with this background in 1977 that members of the STR computer group formally proposed a centralized computer system for the United States trade community. The proposal would make the Department of Commerce the system manager, responsible for maintaining a computer system with data contributed by all agencies concerned with international trade, updating and keeping all information current and accessable to other agencies involved in foreign trade. The STR would chair the Trade Policy Subcommittee on Data, a subcommittee of the Trade Policy Staff Committee and assure interagency cooperation and coordination.

This system would be unique in the federal government among policy making agencies. Its most attractive feature was the elimination of duplication of effort by agencies involved in international trade with a need for trade information. It would require each agency to contribute to an information pool, data it collected or was responsibile for. In return, each agency would have unlimited access to the information pool. Agencies would also share the cost of software and commercial services. The system became known as the Trade Policy Information System (TPIS).

There were some setbacks however. The GIM system, developed to handle data from all agencies in the international trade community, had failed to operate up to expectations primarily because GIM as a standard data base management package required all the data to be uniform to be antered in the system. Trade data contributed to the system from other agencies was not standard in format or composition so another system was needed to replace GIM.

The Department of Commerce was unable to function as system manager for organizational reasons, choosing instead to contribute money and data to the effort. Eventually the entire system would reside on the NIH computer system to provide batch processing capability.

A 1977 document titled, "Master Plan for Computer Operations", the STR Computer Group detailed the strengths and weaknesses of the system:

> The major strength of the computer group as it presently exists is the capability to respond in a timely and cost effective manner to requests. In a larger sense, the major strength of the trade community within government is a growing understanding of the potential offered by the computer and the first steps toward untilizing the computer to assist in the formulation of trade policy. Our success in getting (others in the trade community) to think about integrating computers into the analysis of trade policy is no mean achievement, for these people have often enough witnessed the failure of the computer technicians to deliver reliable services.
>
> Until recent times the computer group has been almost totally devoted to delivering "bread and butter" results. Little time was available for careful consideration of alternatives, despite our long-time recognition of serious problem areas. On such area is the GIM system: while it has been a fairly reliable retrieval system, and a good vehicle for training people about the structure of trade data and the concept of real-time retrieval, the system is (1) much too slow for the kinds of queries we do, (2) far too expensive, both for query processing and data updating, and (3) extremely difficult to change. A second problem area has been the necessity for maintaining parallel but independent systems; the GIM system for certain queries and a remote batch system

for large processing jobs which were impossible to do using GIM.[10]

Lead by the STR computer group, other members of the trade community recognized the drawbacks of the system but also realized the benefits of a fully integrated trade data network based on the shared concept.

The National Institutes of Health, Division of Computer Research and Technology was chosen as the main computer support facility because many agencies already had used the system and it was cost effective, charging approximately forty thousand dollars per year (at the time) for support, batch processing, and on-line access, much less than each agency would have spent individually to support such a system.

In addition to establishing a central collection of trade data, a major goal was to give trade professionals direct access via computer terminals to the data. In order to provide for the most effective access through a user friendly system, a retrieval package developed by STR called the English Language Retrieval System was adapted. It was intended to give professionals direct access to trade data without the need for extensive programming experience. While useful for general purposes, the retrieval system could not serve all information needs, especially those where time series data or complex file structure were involved. Several special programs were developed by STR staff to aid in the use of the information system.

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[10] "Master Plan For Computer Operations", Office of the Special Representative for Trade Negotiations, internal Memorandum, April 13, 1977, p. 3.

By 1979, the data system at NIH was being refined. The newly constituted Office of the United States Trade Representative now chaired the TPSC Subcommittee on Information Systems. By 1981, the Trade Policy Information System had been expanded. In 1984, the system was renamed, Trade Policy Staff Committee TradeNet.

> ...the system provides member agencies with a high quality trade data center directly accessible via dial-out computer terminals. Currently, TPSC TradeNet serves as a source for trade data (imports and exports), trade actions (domestic and foreign), tariff results of the most recent MTN, and other textual files of interest to the trade policy community.[11]

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[11] "Overview of U.S. Trade Data Retrieval Programs in TPSC TradeNet Trade Policy Staff Committee, Subcommittee on Information Systems, April, 1984, p. 1.

Introduction of Office Automation

The development of the computerized trade data base does not reflect office automation as experts on the subject have come to define it, consisting of various types of hardware and software options providing a variety of ways to complete and undertake new tasks or to do work differently. It has become a major component of the tools used at USTR to carry out its duties. Its development is also important because it was the forerunner of the office automation system that eventually developed. In that way, the system served as an introduction for what was to come. It was truly an innovative, state of the art system for government policy making agencies. The interagency trade data base and some additional electronic capabilities evolved over the course of fifteen years. Introduction of a more fully integrated and comprehensive office automation system took place in only five years and for all that has been accomplished, is a hallmark of innovation and resorcefulness.

Development of the office automation functions at USTR did not occur as a result of a mass acquisition of hardware stocked with various software packages and then pronounced as "the system". Neither did office automation derive from grudging recognition of the capability of the expanding computer industry by an established data processing operation. The USTR system evolved deliberately, with as much planning and consideration on the part of the Computer Group and senior management as time and budget would allow. This deliberate, careful, and frugal approach is an interesting one and is primarily responsible for its success.

> By and large, development (of the total system) has followed demand. Development is incremental and cumulative with the need to show some results fast. We also, as in the case of using the NIH center, will make use of existing facilities and resources within the Government. Our approach also emphasizes a strong user orientation with menu driven programs and on-line documentation of systems and files.
>
> We have tended to make use of whatever hardware and software are available; in our minds they are not as significant as creation of a user friendly system.[11]

As a result of close attention to expenditures, use of existing facilities, sharing information and experience, USTR was able to avoid some of the pitfalls that often overcome systems which are overly ambitious, fail to deliver promised results, and prove costly.

The fact that USTR is a small agency of government also plays a large role in its success. Although other agencies undoubtedly have installed office automation systems in some or all of their operations, it is doubtful whether such systems exhibit the integration of the USTR system. A number of recent newspaper articles have described attempts of larger agencies like GSA to purchase personal computers for its regional offices without consideration of existing, unused, computer capacity.

The USTR system has been built on what can be considered a modest sum, for the type of integrated system it is and all of the services it delivers. Less than one million dollars has been spent on the acquisition of hardware in the last six years, while total system expense is less than two million in that same time.

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[11] "Resource Sharing in the Trade Community", professional paper, by Barry Goldberg, Office of the United States Trade Representative, Washington, D.C., pp. 6–7.

The budget for the last five years of Computer Operations Group is on chart # 5. The figures do not represent amounts all originally committed to any of these purposes because some were acquired unexpended funds from other areas of the agency.

Into Office Automation

Early in the development of the trade data base, the intent of the USTR computer group had been to utilize existing CRT's in most of the agencies with trade responsibility to provide access to the central data base. As a part of the TradeNet data system, a report generating package known as "Wylbur" was adopted to allow professionals not only access to the data but to produce reports. This program was the first "word processing" capability available at USTR. It was not word propcessing as we have come to know it today however. Wylbur was not easy to use. It required considerable assistance from someone familiar with integrating data and report generating systems.

In creating basic services such as data retrieval and report generation, a vision of an integrated data, information, and office automation system had become clear

Chart 5

BUDGET OF USTR COMPUTER OPERATIONS: 1979-1984*

Year	1979	1980	1981	1982	1983	1984
Hardware Acquisition	58,095	41,742	256,826	32,455	83,728	28,055
Maintenace	23,456	32,484	45,122	34,803	44,100	76,516
Expendables	3,292	2,607	8,302	4,515		693
Computer Time		51,012	61,248	64,507	59,738	70,789
Data Acquisiton		25,033	2,821	31,089	8,704	9,733
Rentals		-	662	11,259	24,491	71,126
Word Processing Equipment & Service						145,860

* in thousands of dollars

in the minds of the USTR computer group. A system which had started out as a standard data processing operation to collect, sort, and retrieve data for analytical support, spawned development of an interagency data network with a central computer facility that was to be the beginning of a sophisticated office automation system with many unique features.

The first features to be developed were systems for sending messages among and between offices electronically and to keep track of in-coming mail to assure timely response.

Electronic Mail

Although not theoretically unique to the promise of office automation, the creation of a system for sending documents electronically to users of the TradeNet system and others within the agency was ahead of many other such programs in government. In designing the data network, the TPSC Subcommittee on Information Systems knew that most of the agencies participating in the shared data network had some type of terminal allowing direct access to the computer facility. Additionally it noted that most of these agencies had some type of word processing capability, although there was a lack of uniformity between types of systems. Realizing too the importance of inter-agency contact to coordinate trade policy, an electronic mail system was introduced in 1980, using the existing elements of the TradeNet system.

> The electronic mail system (uses) the NIH system as host for storing documents. Users in the agencies can send either short messages or larger papers.
>
> Messages could be sent to single or multiple recipients on the network. Agencies had the option of keying

> in text directly using WYLBUR at NIH or by transmitting files created on their in-house word processing systems. This type of approach left agencies to pursue their own development paths while still being able to be a part of the larger network.
>
> The electronic mail system is a store-and-forward system which depends on recipients to sign on to the host system at NIH to receive messages or notification to retrieve a longer paper stored on disk. One problem was to find an incentive for them to sign on to the system frequently. We have decided to publish a calendar of daily meetings and events being held at USTR, since most of the agencies send people to USTR daily to attend one of 40 subcommittee meetings...
>
> Other calendars were added as people became more familiar with the system. The International Trade Commission added a calendar showing trade decisions being considered by the commission each week.[12]

When it first became operational, electronic mail was not available to each staff person at USTR through individual terminal In 1980, USTR had only begun to purchase terminals for otners outside the computer operations group. To use the electronic mail or data base systems, it was necessary to use one of the few terminals available through the computer operations group.

Chart 6 lists the number of documents sent and received using the system by USTR since 1982, when a record was first begun. For the period shown, with direct access still limited by lack of direct dial up capability of most USTR terminals, the number of documents sent by USTR is relatively consistent averaging about 70 to 80 per month. There are times when traffic on the system slows, both going and coming.

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[12] "Resource Sharing in the Trade Policy Community", professional paper, Barry Goldberg, Office of the United States Trade Representative, Washington, D.C.

Individuals in other agencies also had difficulty using the system because of a lack of available hardware and tecnnical help in accessing the system.

Chart 6

NUMBER OF ITEMS RECEIVED/SENT BY TPSC ELECTRONIC MAIL SYSTEM

	1982	1983	1984
Jan.		980/121	840/88
Feb.		560/121	784/90
March		420/77	814/93
April		910/121	615/67
May		770/121	357/67
June		1050/132	424/61
July		490/66	535/66
August		350/55	374/51
September	840/165	630/39	462/55
October	560/99	560/77	
November	560/110	490/55	
December	700/99	420/55	

Correspondence Control System

Under development at the same time as electronic mail system, a system was designed to keep track of the increasingly large amount of correspondence directed to the agency partly as a result of its expanded role and influence in U.S. trade policy.

The correspondence control system was introduced in 1981 utilizing the agency's in-house computer hardware. It allowed incoming correspondence to be processed in a central location, a record of the date, subject, name of the originator, and the name of the USTR section to which it was being assigned for response depending on the subject. It could be assigned a date by which the letter should be answered allowing for proper clearances. This system also is unique for a policy making agency, in a visible position, where response to the mail is an important function.

Consolidation

The third important event to affect the development of office automation at the agency was the introduction of personal computer and programs into the workplace in the late 70's which made routine and time consuming jobs easier and faster. By the time of their appearance, STR Staff members had become somewhat familia with the capabilities of word processing systems. The experience that some had had with the report generator "WYLBUR" helped make them advocates of a system with expanded capabilities. With it. experience in developing the trade data system, USTR was well positioned to take advantage of the new capabilities. They would be able to offer office automation services to the staff with less startup time and cost than other organizations. The base for a consolidated and integrated system was already in place.

It is an interesting footnote that in 1979, a study of a reorganization of the Executive Office of the President ordered by President Carter recommended consolidating all data processing and word processing of the Executive Office operations in one location, with control for planning and operation in the hands of the White House Office of Administration. After review by the study group, it was recommended that USTR remain seperate from the automation efforts of the Executive Office because of their advanced state of development and the special nature of the trade data base as a policy development tool. It is interesting to note further that the office automation program of the Executive Office is still proceeding after the purchase of numerous stand-alone units, no central core for interface and communication, and unused minicomputer capacity.

In a memo to the newly appointed U.S. Trade Representative in 1981, the Director of Computer Operations reiterated the outline of the plan for office automation:

> Since our (the computer group) inception, we have provided computerized trade data to USTR professionals; we are in the process of improving our services by giving trade professionals direct, "hands-on", access to their data sources. The Computer Group is also implementing a long-term plan to create within USTR an automated office which features word processing, document storage and retrieval, electronic mail, and other office aids.

The long-term plan refered to had begun with the development of the trade data base. The next step would be to acquire a word processing capability and provide staff with terminals for access. At this point, 1980, the agency had acquired, in addition to a Nova II computer to do in-house data manipulations and communicate with the NIH system, a Data General N.V. 8000 minicomputer with the capability of supporting 128 users.

As a part of the plan to introduce office automation slowly, terminals were placed in only a few offices at USTR.

A word processing package called AZText was made available to terminal users. There was still no connection for these terminal directly to the TradeNet system or the electronic mail system, which would require telecommunications capability.

Before going further with the development of the office automati plan, a study was commissioned by USTR to determine the word processing needs of the agency. Among other things, the study evaluated how much typing was done by the secretarial staff at USTR and whether the existing machinery was sufficient. It also evaluated word processing from the point of view of ultimate cost of harware and manpower between the exisiting systems and an automated word processing system. In addition, the report found that 59% of the professionals would be willing to use a terminal to do initial drafts of documents.

Among the most important results of the study was a recommendati that the ultimate configuration for the USTR office automation system be a combination of "stand-alone" units (smart stations, PC's in other words) and shared logic terminals. In the optimum system, the stand-alone units and shared logic stations would (1) use the same software so that operators and text could be interchangable between units, (2) would all be linked througn telecommunications, (3) could access other aspects of the office automation system -- such as electronic mail and files in established data bases, and (4) could share common resources such as printers."[13]

The report recommended a configuration of equipment that called for "11 stand-alone terminals, 14 shared logic terminals and thirteen to fifteen letter quality printers".

But the agency was able to do much more, as the system began to grow. As professionals gained experience using the system, others asked for terminals of their own. The 1983 year end report of the computer group was able to note the "acquisition and installation of more than 50 video terminals throughout USTR to support office automation and trade data needs and the addition of 60 new user accounts".

In 1983, USTR acquired a new word processing package, SSI WordPerfect, which was more adaptable to both stand-alone units and shared terminals. The new package contained many features required for complex editing and revising of documents. It also provided for easy storage of documents on computer disks.

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[13] "Evaluation of Word Processing Requirements", Fourth Report, Kendrick and Company, Washington, D.C., June 29, 1981, p. 1.

The computer group had begun the process of procuring stand-alo terminals for flexibility. The 1984 year end report noted "the successful completion of a 10 month process for competitive procurement of eighteen microcomputer work stations networked to the Data General Minicomputer to replace the out-dated IBM Mag Card equipment for support staff".

In addition to the terminals already in place, the total number of terminals providing access to the USTR system presently is one hundred eleven, eighty-one shared logic terminals, eighteen IBM PC's, and 12 dial-out terminals, a ratio of more than one terminal for every two employees if all individuals working at USTR are taken into account, including contractors, part-time employees, and individuals on detail from other government agencie If only the permanent, full-time alloted positions of one hundred thirty one are used, the ratio is very close to one-to-one.

Training

Organized training activities for users of the trade data system expanded in 1981 as terminals were placed in several USTR sections and the number of agencies signed on to share the data retrieval capabilities of the system had increased.

A manual describing the trade data base was issued to users of the system providing instruction in how to access and utilize the trade data. The USTR staff also offered training sessions for users of the system.

> The Trade Policy Information System users manual was issued in January (1981). It documented the available systems and data files contributed by the Trade Policy Staff committee agencies and provided easy to understand instructions for use. In addition, it served to familiarize trade professionals in the Government community with the concept of a centralized computer network...The manual documented a generalized system for retrieving trade data called the English Language Retrieval System, a Report Generator System, the U.N. Data System, and the popular TPSC Electronic Mail System.
>
> Beginning in June (1981), training sessions were held on specific systems in the network. Twenty support staff from various agencies...attended training sessions on the Electronic Mail facility...[14]

Training also began in earnest for USTR staff:

> A three part program was initiated to orient USTR staff to the capabilities available of the in-house computer and to train them on specific appications. The USTR Computer Users Manual issued in June, compiled instructions for using a variety of information systems and products which the computer group has developed over the years. Formal group training and orientation sessions were held in June. Lastly, individual training sessions and on-going technical assistance has been provided on demand to users as they begin using the computer capabilities. A staff of "information counselors" has been designated within the Computer Group to perform these functions.
>
> Over forty staff members attended the training sessions. An overview session introduced the participants to the computer and the computer terminal and provided an a introduction to the applications available such as trade data retrieval, correspondence control, word processing, access to directories, calendars, and capabilites for building individualized information systems. Subsequent sessions on office automation provided hands on training on internal electronic mail, correspondence control and word processing.
>
> Subsequently, we have conducted numerous individual training sessions upon request. We have worked individually with several USTR units to help them use the computer

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[14] "Annual Report of USTR Computer Group Activities", September, 1981, internal agency document.

> systems to build information files designed to address their specific needs.[15]

The "information counselors" refered to above consisted o six new employees hired to assist with the introduction of th system throughout the agency. This was the first change in agency personnel linked directly to the introduction of automation. since 1975 when three computer experts were brought into the agency as contractors. Since their addition to the staff, the new employees have been busy responding to requests for assistance from system users, fulfilling requests for data from the TradeNe system (still not directly accessible from user terminals), as well as system maintenance and expansion. Additionally, six part-time student workers were added to assist with the increasing work load of the Computer Group including maintenance of th trade data system, correspondence control system, requests fo use of electronic mail, requests for special applications of the trade data base, update of the training manuals, and prepar of the daily newsclip service.

Training was arranged for secretarial staff members after the acquisition of 18 IBM personal computers in late 1983 and the first part of 1984 utilizing an IBM employee to conduc training classes on the machine and the SSI WordPerfect packag All secretarial staff selected to receive a stand-alone unit were given the training course. According to the responses during the interview portion of this study from those who had taken the training, all found it to be unsatisfactory because the leader of the sessions did not attempt to explain many of the technical details of the PC as they were introduced. The trainer also used "computer language" to describe the operation of the machine and its functions. As a consequence, most of those attending the sessions required additional assistance from members of the Computer Group Staff after the machines had arrived. USTR has 36 more IBM PC's and printers on order for use by secretarial and professional staff. The method of selecting which individuals would receive stand-alone units was based on configuration suggestions of the Kendrick study, requests of section managers, work load, and the need for flexibility. All secretarial staff will eventually receive stand-alone machines to assure flexibility and access to letter quality printers. One of the most common complaints from system users, both professionals and secretaries, was the unreliablity of the line printers dedicated to the in-house minicomputer system. Users complained they would often have to wait long periods of time while other jobs were run on printers; printers would fail while printing documents, requiring the assistance of the Computer Group; paper would jam or run out in the middle of a print job; and staff would be running back and forth between printers and their terminals to set up print parameters.

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[15] Ibid.

Because the system has expanded almost a hundred fold in the last two years and because capabilities have expanded with the addition of new software and programming changes, the need for significantly improved training facilities has been realized and is being addressed:

> Because of our growth in processing capabilities with the IBM PC's software, new application on the Data General, and the user friendly trade retrieval programs at NIH, the old method of training both our Computer Group staff and subsequently our end-user population is grossly inadequate. We have identified agency-wide training needs and Computer Group staff training needs...

The choices identified in this memo were to either contract with outside sources for training all USTR staff, amounting to the expenditure of large amounts of money for essentially one time training sessions or to train members of the Computer Group staff so that they could conduct in-house training sessions.

> Based on the number of users (over 100), contracting for training sessions to train our users on only four relevant software packages would run the agency between $800 to $2500 per person, depending on the depth of the training. Even if we restricted complete training to 75 users, (the cost would be) between $60,000 and $187,000.
>
> Alternatively, to adequately train 10 Computer Group staff on the system and application aspects of the same packages would cost about $25,000.[17]

The advantages of this approach, outlined in this same document, are that contractor based training provides no additional assistanc after the trainers are gone; Computer Group staff would be able to assimilate information provided in a training session much faster and more completely; personnel turnover means expensive training is lost when the employee leaves; regularly scheduled

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[16] Internal agency memorandum, "Agency Wide Computer Training Needs" August 3, 1984.
[17] Ibid.

on-site training sessions would be able to assist new users as needed and provide new information to old users as needed. This option has been adopted in addition to tne creation of space and equipment for a training center at the agency.

Also useful would be seminars desigend to demonstrate how automated functions could be applied to particular functions and areas of responsibility. Senior staff may benefit from "conceptual" training intended to show specific uses of the various functions of the USTR system.

The Geneva Office

One of the initial insentives for automation at USTR in the early days was to bring the office in Geneva in closer contact with the Washington office. Closer contact and coordination is still a goal. Allowing the Geneva office to share in the capabilities available on the USTR system would help both offices communicate and coordinate their activities.

Besides the capability to receive data on high-speed transmission lines from the TradeNet system, the Geneva office is able to utilize a commercial service for "electronic mail". A GTE Telenet system is available, which allows Geneva staff to leave messages for Washington staff to be retrieved at more convient hours. This system is also available to USTR staff on either domestic or foreign travel to provide contact with either office. The system is described more completely below.

As this study was being conducted, USTR Computer Operations staff were involved in major design of a fully integarated system for the Geneva office including the acquisition of stand-alone units, and a telelink to connect the office directly to the system in Washington providing real time communication.

Limitations

A problem that has slowed the ability of users to access all of the capabilities directly from their terminals has been a constraint imposed by location of the where the office iin a historical building. All of the terminals at USTR are connected to the minicomputer, which is located two blocks away, by short-haul modems hard wired to the system. There are not enough phone connections to allow for electronic hook-ups directly to each terminal. Additional phone lines could not be installed because of architectural restrictions on physical reconstruction.

Recently, hardware was added to the offsite minicomputer that allows each system user to access outside systems through a telecommunications package. Users, as of December, 1984, can access all of the system capabilities directly without going through the Computer Operations staff.

Security is also a major concern of the system. Equipment rated secure by government standards is required for classified information. Transmission of the same type of material also requires security approved sending and receiving equipment, including secure transmission lines. The USTR system configuration does not meet these standards and is therefore limited to storing or sending only information not classified in some security category. To make the system secure by government standards would require that the offsite minicomputer, which supports all users and capabilities, be moved to the building where USTR staff are located. Space and architectural limitations imposed because of the historic nature of the building, makes this option unacceptable. The Director of Computer Operations estimates that $2 million dollars would be required to purchase additional hardware to assure machine security, not to mention the need for additional money and hardware to secure each terminal.

SYSTEM DESCRIPTION

Hardware

Hardware supporting the USTR office automation system inclu One Data General MV 8000 minicomputer including two 192 megab disk drives with 6 megabytes of memory; two synchronous lin one line printer; ten letter quality NEC Spinwriter printe two tape drives; 98 ports and 1 port selector. This mach is dedicated to general use and supports the system terminals.

The system also consists of a Data General MV 6000 includ one 192 megabyte disk drive, one 50 megabyte disk drive, megabytes of memory, 32 ports, and a multi processor communica adaptor. This machine is dedicated to system backup and prog development.

User equipment presently consists of 81 Gata General sys consoles in three different models, all with the same capabili 18 IBM Personal Computers with 320 kilobytes of memory; 18 Spinwriter letter quality printers; all are equiped with Gand short-haul modems for connection to the Data General minicompu system. None of the terminials have modems allowing access on-line connection with other systems although this capabil has been added to the Data General system allowing the u to dial-up other systems through two autodial modems.

Other Systems

Facilities at the National Institute of Health, Division of Computer Research and Technology Federal Data Processing Center provide mainframe capability. This facility serves as the trade data depository to which other agencies of government contribute either data or money for its support in a unique arrangement in the federal government. This facility is also the one used for support of the TPSC Mail system mentioned above.

System Capabilities

Listed below are brief descriptions of each of the features of the USTR system as outlined in the USTR "Information Services Guide" given to USTR staff in October of this year. Until this time, most of the capabilities were available only indirectly because of a lack of telecommunications capabilities described above. As a result, most system users accessed the word processin package exclusively as it was loaded directly on the minicomputer and did not require telecommunications capability.

The guide lists system services in nine components:

1. Office Automation
2. Communications
3. Data Bases
4. Trade Action Monitoring Reports
5. Executive Secretariat/Library
6. Management Systems
7. Internal Publications
8. Training, Technical Assistance, and Documentation
9. Other Support

Office Automation

This category includes: word processing, spreadsheets, graphics, automated information management (AIM), and menues.

SSI WordPerfect is the word processing system currently in use on both the Data General system and in the IBM personal computers.

SSI Mathplan is the spreadsheet program available on the Data General system. It has only mathmatical capability and cannot be used to make charts or graphs.

The Automated Information Management (AIM) system was developed some years ago as an in-house online data management system. AIM allows the user to store large amounts of information in a central file and manipulate it to display and print only that information desired in an individually designed format.

Graphics capability is available only with the assistance of the computer operations staff at the moment. Off-site support for a graphics capability is availble when a powerful statistical package such as SAS is required. Lotus 1-2-3 is available on a IBM PC workstation with color capability.

Menues refers to several information options available to USTR staff.

- o Word Processing - allows user to work in WordPerfect
- o USTR Magazine - displays the main menu of the USTR Online Magazine containing information on USTR schedules, recent trade and labor situation summaries, DRI economic news, and USTR computer system information.

- Trade Data - displays menus leading to data on bilateral trade balances, imports and exports on a five- and seven-digit basis, keyword lookup for specific nomenclature numbers, domestic and foreign trade action reports, and the GATT document index.
- Personnel and Administrative Information - allows the user to view and search USTR personnel lists for section, room, and phone information, and gives access to the internal electronic mail system.
- Automated Information Manager - access to AIM system
- File Management - allows users to search files in her/his directory by keyword strings, delete files no longer needed on-line, and edit files using the SED text editor.

COMMUNICATIONS

This title refers to a group of services which include internal electronic mail, interagency electronic mail (commonly known as TPSC Mail), and GTE Telenet Telemail.

The internal electronic mail system allows users of the Data General system to send and receive messages and completed document to each other.

TPSC Mail enables members of the Trade Policy Staff Committees to communicate. Its most frequent use is the transmission of unclassified documents pertaining to trade matters under consideration by the committee or subcommittee.

The system serves nine agencies with multiple users in each.

They include: The Office of Management and Budget, Departments of Agriculture, Commerce, Interior, Justice, Labor, State, Treasury, and the International Trade Commission. The actual mechanism for holding and transmitting messages is the mainframe computer at the National Institute of Health which is also used to store the trade data bases.

GTE telenet telemail system is available by dialing a local access number and allows the user to "deposit" mail in other boxes on the system. USTR currently has mailboxes for the Washington office, the Geneva office, USTR Ambassadors and a "travel" box which can be used by staff members on domestic travel to transmit or receive messages twenty-four hours a day. Portable terminals are available for staff members to use on domestic travel.

It is also possible to use this system to transfer documents into the word processing systems in Washington and Geneva, allowing local modification and printing without re-typing.

This capability is relatively new and to this date has not been generally available to system users but required the assistance of the Computer Operations staff. New programing, now complete, will allow system users to access this capability directly.

A telecopier is available to transmit facsimile copies of hard copy original documents. This service is not available to system users and requires the assistance of the Computer Operations staff.

Finally, a Western Union Telex II is available for transmitting messages to all other domestic or international Telex locations.

It must be stressed that documents sent by any electronic system described above are unclassified. Government regulations orohibit the use of non-secure machines to transmit any but unclassified documents. All other documents must be transmitted via the State Department cable system to international locations. Security is an ongoing problem to a fully integrated system.

DATABASES

The category of Databases includes an extensive array of information compiled since automation began at the agency and new services added as they have become available.

Data and statistics related specifically to trade are available to systems users from the in-house Data General system. This data is used by the agency generally. It also contains specialized databases developed for particular individuals and sections within the agency.

Trade statistics available on-line include:

- o U.S./World Balance - displays U.S. trade balances with the world from 1972 through 1982 and year to date figures for 1982 an 83.
- o Balance - displays bilateral tade balances between the U.S. and any user-defined country or group of countries.
- o Imports - displays dollar amounts of imports on a five or seven digit Tariff Schedule of the U.S. Annotated basis, for major country groupings and top ten suppliers.

- Exports - displays dollar amounts of exports for major country groupings or top ten suppliers.
- Keyword Lookup - searches U.S. Tariff Schedule and Schedule B descriptions to produce a lits of item numbers to be used in the TRADE programs.

Another addition is being developed containing statistics from the Bureau of Economic Analysis including U.S. direct investment abroad from 1950 through 1982.

Interagency databases refer to the wide range of trade and economic data available from the facility at the National Institute of Health. As mentioned earlier, the consolidation of data relating to international trade was one of the prime motivations in building a computer capability at USTR which led to the development of other features of office automation.

This system, known as TPSC TradeNet is managed by the Trade Policy Staff Committee Subcommittee on Information Systems, a part of the coordinating system of USTR. The Subcommittee is chaired by the Director of Computer Operations.

TradeNet, the successor to the Trade Policy Information System, and renamed in 1981 was developed as a central source for the storage, retreival and processing of trade information. TPSC TradeNet provides member agencies with trade data accessible through dial-out computer terminals including data on imports and exports, trade actions (foreign and domestic), tariff results of the most recent Multilateral Trade Negotiation sessions, and other textual files of interest to the trade policy community.

Data may be downloaded to the users terminal from the system for processing or on-line for processing at the NIH facility.

Member agencies have unrestricted access to the files and services of TPSC TradeNet. These agencies have the responsibility of contributing to TPSC TradeNet, original files in their speciali area along with files they may have created using TradeNet and those developed within the agency.

This system also contains data from the U.N. Trade Data System which is data reported to or estimated by the United Nations based on information collected member countries. The system allows the user to retrieve data from about 160 countries who report activities with approxiamtely 230 trading partners.

All of this capability was the result of an effort to centraliz data used by policy-makers in the international trade area. The stated objectives of this effort are to:

- "reduce outlays (of members) for computer equipment, software, and support personnel;
- eliminate the duplication of data bases and programs among TPSC member agencies;
- efficiently disseminate important trade information to those within the government who require it without putting additional strain on agency personnel;
- allow easy and immediate access to information by training users to retrieve information directly;
- eliminate costs associated with the creation of customized

reports at individual request by providing a report program easy for each individual to use;

- to provide timely information to policy-makers and assure that accurate information is used by all".[1]

Finally, a number of commercial data services are available under this function. They include: Bibliographic Reference Service and Dialog; Dow Jones News/Retrieval; Data Resources, Inc.; Globe, Chase Econometric's Global Lending and Overseas Banking Evaluator; Washinton Alert Service; and Westlaw.

TRADE ACTION MONITORING SYSTEM

The Trade Action Monitoring system (TAMS) gives the user a history of decisions of the International Trade Commssion and the Commerce Department regarding trade actions conducted under their purvues.

The Foreign Trade Action Monitoring System provides a record of tariff and non-tariff measures imposed by the major industrialized nations.

EXECUTIVE SECRETARIAT/LIBRARY

This function gives the user access to the Correspondence Control System, Weekly Events Calendar, and the Index of Responsibilities. One individual was assigned responsibility of assigning incoming correspondence and keeping calendars current to maintain order on the system. The addition of this position is one of the visible changes in organization as a result of the development of office automation besides the addition of seven contract employees to the Computer Group staff in 1981.

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[1] TPSC TradeNet, Volume 1, Beginner's Reference Guide, Trade Policy Staff Committee, Subcommittee on Information Systems, July 24, 1984.

MANAGEMENT SYSTEMS

Accounting/Personnel System is used to log and track details concerning the travel of USTR staff including destinations, when they travelled and the cost.

Correspondence Control System is an innovation of USTR to keep track of all correspondence addressed generally to the agency. A letter received by the Executive Secretariat is forwarded to the particular section responsible for the issue or concerns raised in the letter. That section is then responsible for drafting a reply within a certain time period. A letter may be marked for the signature of the USTR, a deputy or an Assistant USTR.

This system monitors the progress of the letter through the agency as it is drafted, cleared, signed, and sent. A user can search the system by letter author or subject. It is particularly valuable because of the role of USTR as a public contact for international trade concerns and Congressional requests.

Index of Responsibilities contains the names of all USTR staff along with room number and phone extension. The system can report the staff by unit or by trade subject area and responsibility.

Room Scheduler is used to determine what events are scheduled for conference rooms in the building or when they might be available. Users may not schedule rooms directly but must arrange time from the Executive Secretariat.

Weekly Events Calendar reviews scheduled activities and events of interest to USTR staff such as interagency meetings, private sector groups, Congressional hearings or action, international meetings or negotiations, recent trade actions, and media events.

INTERNAL PUBLICATIONS

Newsclips are a daily publication and include articles from five domestic and international publications. A central file of items appearing is kept as reference.

Computer Notes is designed to keep USTR staff informed of new developments on the computer system such as the addition of resources, services, or operation capability.

TPSC TradeNet Newsletter is published monthly by the Subcommittee on Information Systems and is concerned with topics of interest to the interagency membership of the Subcommittee.

INTERVIEWS

To determine what the impact of office automation has been on the agency and the individuals using it since its introduction two years ago, personal interviews were conducted of a randomly selected number of agency employees at each level: secretaries, professional, and senior staff.

A total of 37 individuals were interviewed including ten senior staff, fifteen professional staff, and twelve secretarial staff members.

Senior staff members interviewed included seven of eleven Assistant United States Trade Representatives (AUSTR), each of whom is responsible for overseeing analysis, evaluation, and implementation of policy with regard to trade issues in particular geographic sectors of the world such as Europe and Japan or in specific product groups such as Industrial and Energy Policy. Each AUSTR reports to one of two Deputy USTR's in Washington. One Deputy Assistant United States Trade Representative, who reports to an AUSTR, was interviewed.

Additional interviews were conducted with the AUSTR for Administration, responsible for all administrative and personnel matters of the agency including computer operations, Congressional Relations, Public Affairs, and Private Sector Liason; Special Assistant to the USTR; AUSTR for Congressional Affairs; and the General Counsel, responsible for legal affairs.

Four of the ten senior staff interviewed had terminals on their desks, the others did not have direct access to computer terminals.

Out of the one hundred twenty five professional staff (including personnel from other agencies) at USTR, fifteen were interviewed. Their titles include:

- o Director, Technical and Trade Barriers
- o Assistant General Counsul
- o International Economist (4)
- o Director, Mideast and African Affairs
- o Director, Trade Policy Committee
- o Deputy Director, General System of Preferences
- o Director for European Communities
- o Trade Policy Committee Staff Assistant
- o Director of Personnel
- o Senior International Economist
- o Director, European Free Trade Association
- o Director of Computer Operations

Professional staff at USTR are assigned responsibilities in particular areas, products, or programs within a section headed by an AUSTR. Their duties involve the administration of programs established by international trade agreements; analysis of factors influencing proposed negotiations; responding to inquiries from businesses wanting relief from or imposition of trade and tariff rates and regulations both imposed by other countries or in force in the United States; staffing committees or subcommittees of the Trade Policy Staff Committee to coordinate the views of other government departments into policy positions; informing superiors of developments with respect to trade and tariff changes in other countries; and helping prepare and assist with negotiations over trade regulations and tariff rates with other countries. All of these tasks require a great deal of writing. All documents prepared for distribution outside the agency require clearance by a member of the senior staff. All documents dealing with trade policy positions which are discussed by subcommittees of the Trade Policy Committee process must be cleared by the agencies with an interest in the issue as well.

All but three of the professionals interviewed had computer terminals at their desks. None had stand-alone personal computers.

Secretarial staff at the agency currently number forty six, including three confidential secretaries. There are no other designations at this level. A total of twelve secretaries (including one confidential secretary) were interviewed.

On average, there is one secretarial staff member to four professional staff in each section. At least one secretarial staff member from ten of the seventeen USTR sections was interviewed. Two secretaries were interviewed who did not have terminals or stand-alone computers at their desks.

Interviews were conducted in person, one individual at a time, following the interview protocol shown as Appendix A. Each interviewee was encouraged to elaborate on any responses.

Not all of the areas covered in the questionnaire could adequately be evaluated by quantitative indicators. These question areas relied heavily on explanations of interviewees.

RESULTS

When examining information obtained from the questionnaire portion of this study, it must be kept in mind that terminals had been available to most of those interviewed for a year and a half to two years at most. Few USTR staff used the system directly before that. During the last two years, word processing and a few aggregated trade figures from the TradeNet system were the only functions directly accessible.

Also keep in mind when reviewing responses, that office automation is a recent development and as such, work patterns, habits, expectations, and performance are still in the process of changing. In this respect it was difficult for some respondents to recall how they worked previously, even though the time frame may be short, and conversely it may be difficult for others, like senior staff to notice a significant change because they have not participated as fully as others. In either case, the "norm" is presently in flux. As a result, impressions of how individuals or the agency has been affected differ. Some have already forgotten how things used to work, others see no difference in before and after.

Detailed responses to each question are contained in Appendix B.

Who Uses the System

One of the more interesting results discovered in responses to the questionnaire is the difference between frequent users of the system, principally professional and secretarial staff and infrequent users, those without terminals and the senior staff.

Professionals and secretaries with terminals on their desks said they used the word processing capabilities of the system extensively. Senior staff, about half of whom have terminals in their offices including the USTR, the Special Assistant and the AUSTR for Administration, use their terminals or the automated services infrequently. The reasons most often cited by senior staff for infrequent use are that they do little creation or revision of documents or data retrieval and analysis. Because the agency is so small, use of the calendar function is not crucial or that much more beneficial than going down the hall to inquire into plans or schedules of other staff.

Use of electronic mail is not practical either internally or between agencies because senior staff counterparts in other agencies have no access to the system on a regular basis.

Senior staff members rely on their staffs to produce required documents or data on request. They rely on the telephone or short memos and letters to conduct business. The functions of senior staff, with respect to those they supervise, are to assign, monitor, and manage the development of policy response and policy initiatives.

Negotiating trade issues, or discussing policy options with other senior government officials, duties primarily reserved for senior staff, requires face-to-face contact with counter-parts in other countries, or government agencies say most senior staff members. When asked about the possibility of teleconferencing technology as a means of conducting trade talks, a senior staff member volunteered that "diplomatic niceties" have precluded its use thus far. Another suggested that good negotiation required "looking into the face of the person on the other side of the table to determine his real intent". Counterparts in other countries and in other agencies do not use office automation extensively and as a result USTR senior staff continue to rely on established methods. In time, as other agencies and other countries acquire the capability to access and utilize the USTR system, it will have already been in place and well developed. As that happens, one would expect that the habits of senior staff in other trade agencies would begin to change. Senior staff are beginning to rely on the GTE telenet system to receive and leave messages for and from the Geneva office when time differences make contact by telephone impossible. Each senior staff member interviewed said they used the telenet system at least once a month.

As a result of not having a need to use a terminal, half of the senior staff interviewed expressed some reluctance about learning how the machinery operated. Senior staff had never been offered a complete training course like other staff. An introduction to the system and its capabiities was provided by the computer group. A more thorough training program is planne for senior staff as outlined in a previous section of this report.

The opposite was true of most professional staff. In the absence of time or opportunity to participate in formal trainin sessions, all said they learned the most about how the system worked by "playing with it". That is not to say that they approac the computer or the terminal as a toy, which some articles in popular literature have suggested is the vision executives have of the uses employees make of this expensive equipment. Each person suggested that it had taken some time to become comfortabl with the idea of typing rather than writing or with where documen went when stored and how they came back out.

Training by outside sources of both professional and secretari staff was cited often as one of the least attractive experiences with USTR automation thus far. Because computer operations personn were engaged almost full time in system construction, maintenance, and responding to requests for assistance, little other organized training was available. Computer Group personnel were cited by all respondents as the most helpful in assisting with problems and questions even though they were not always readily available.

A "control desk" has been established recently to assure that someone is available to answer questions or help solve problems during business hours releasing the computer group staff for other tasks including advanced training sessions.

Time Saving

Another interesting finding was the amount of time USTR staff estimated they saved carrying out their responsibilities. Professional staff with terminals on their desks estimated on average, that they spent as much as 75% of their day using it. While 80% of all staff with terminals said they used the terminal everyday, 100% of professionals and secretaries said they used the terminal at least once every day. The most frequent use for both professionals and secretaries was in drafting or revising documents of various lengths. Professionals particularly were of the opinion that they could get their work done much faster using the terminal and word processing capability to do drafts of documents both long and short, than using pencil and paper. Time savings included being able to revise without first getting several typed drafts from their secretarial support.

Some professionals said that their ability to store and retrieve documents on-line made it easier and more convenient to reuse previously drafted material and parts of old documents to construct new ones. Some professionals said that as they were often required to submit regular situation reports for various purposes where format and often the situation had not changed markedly, they would update the last version rather than recreating a "new" document each time.

Each was asked to estimate how much "faster" they believed themselves to be in relation to what each thought of when considering this change in the ability to do their jobs. Without exception respondents described a decrease in real time of 50% needed to complete a project from start to finish including; drarting, rewriting, clearance and final copy of memos, letters, position papers, briefing documents. Examples included: a two page letter before automation may have taken as much as four hours of a professional's time including drafting, revising, proofreading, and clearance. That time could be cut to an hour or less using automated word processing; a major paper that previously took two weeks to complete could be done in several days.

Work Flow

Most professionals described increased self sufficiency in document production as the greatest time saving as well as adding greater satisfaction to the job. Without the need to rely on secretarial support to do drafts, rewrites, or make copies, the process became not only faster but less stressful. Both professionals and secretaries noted that no longer needing to "wait in line" for a secretary or having other priortites interupt made for a much less stressful work environment. Secretaries commented that they believed there was less anxiety on the part of professionals who used to wait for typing and less stress on secretaries as a result. Many professionals said they no longer spent time "hovering" around a secretary as she worked on a document. They also noted that the ability to print documents on remote printers gave them greater independence in document creation, storage, retrieval, and revision even though remote printers presented one of the greatest frustrations because of the time spent waiting for other print jobs to finish, putting paper in the printer, and system failure.

Responses to questions seven and eight in the questionnaire provide some indication of how much change has occured in the flow of work between secretaries and professionals. In response to question seven about the amount of time devoted to typing before and after automation, some secretaries reported a significant reduction in the amount of time they spent typing, while others reported some increase in the amount of time they spent. As a result, there was no difference before and after automation in the aggregate. But in fact some secretaries had reduced their time spent typing from twenty to forty percent depending on whether or not they worked for professionals with terminals who do most of their own typing. Some secretaries said they spent less time typing but did the same amount of work or more because they typed faster and more efficiently. Others said they spent the same amount of time typing but typed a greater number of documents. In question eight, professionals and secretaries were asked how many documents they submitted/received for typing before and after office automation. As in question seven, the number of documents received by secretaries in an average day increased or decreased depending on whether a particular secretary worked for professionals with their own terminals. Some secretaries reported that the number of documents they received had been reduced to as few as one letter or memo a day or one longer document on occassion. Professionals with terminals indicated that they submitted virtually no documents to secretaries for typing after the introduction of office automation, prefering instead to do their drafting and final copy on their own terminals and produce them on remote printers.

Additional Responsibility

Respondents were asked whether or not their work load had increased as they spent less time on assignments. Again, without exception, professional staff responded that neither their work loads or their responsibilties had changed. The ability to complet an assignment or carry out a responsibity in a more timely manner freed them to "clear the backlog" of things they had always had to do but which often fell behind as priorities were rearrange

This was supported by the response of senior staff when asked whether they noticed any change in the time taken to complete assignments. Generally the response was that they noticed no change, that is as far as they knew "work still gets done". As mentioned above, senior staff were not as involved with using the system as other USTR staff and therefore might have less of an idea of time saving than those with direct contact.

Some senior staff said that they had become more conscious of time saved and as a result delayed making assignments knowing their staffs were able to meet shorter deadlines. Professionals also noticed that deadlines on occassion had moved up as the ability to meet them had improved.

Changes in Work Characteristics

Most frequently mentioned changes to individuals from the office automation system involved work habits and performance. Professionals described significant changes in individual writing style, noting how word processing capability enabled them to spend more time thinking about their subject and asserting that the finished product was better. Many noticed that being able to see their work immediately helped their writing to become sharper, clearer, and more concise. One person compared writing with pencil and paper as opposed to writing using a terminal to writing in one dimension compared to three dimensions. The ability to "see" how pieces looked together, along with an ability to move sentences and paragraphs around aided clarity.

Some professionals said they had been aware of shortcomings in their writing before but that word processing capability gave them the opportunity to correct mistakes and rewrite, where previously the press of time and access to secretarial support had not provided that option.

Senior staff, again without exception, suggested they were more likely to send a document back to correct small errors or to add clarifying words or sentences because they knew it would take much less time than retyping the entire document.

Secretaries responses to the question of how automation has aided them in doing their jobs echoed the professional staff. Each secretary interviewed said that word processing had decreased the amount of time they spent on each individual project.

Secretaries also estimated that they had become 50% faster at completing their work. A majority of those interviewed said they had much less typing to do because the professionals with whom they worked did much more of their own typing, revising, and production. Those that worked for professionals without terminals said they did as much typing as before but that it was faster and easier.

Another feature of the USTR system often cited by respodents as a time saver, is the ability of a secretary to retrieve a document out of an electronic file of a professional to make changes in, or print documents. Secretaries who have stand-alone personal computers tied in to the agency-wide minicomputer, have the ability to copy documents from a file on the minicomputer onto diskettes. This dual system was mentioned as a benefit particularly when the minicomputer system "goes down". The biggest single complaint of the professionals who use the automation system extensively was how their work came to a virtual halt during "down" periods, even though down time, according to system records, is only two percent of operating time per year.

Changes in Personal Habits

Of the habits mentioned in question three, most respondents said their habits had not been affected by office automation. Exceptions included those who slept better because of reduced stress; found more time for personal development; found more time for recreation or reading for pleasure all as a result of being able to get work done faster and better while at the office.

Changes in Personal Work Habits

The most interesting finding here was that even with office automation all staff spent virtually the same amount of time at the office as before automation, except for fewer overtime and weekend hours, as hours are fairly well set by the amount of contact with people outside the agency which requires most to be at the office between nine and five.

Secretaries reported a reduction in overtime hours. The number of overtime hours was not able to be determined exactly so there is no independent confirmation.

Job Satisfaction

There was a wide disparity in responses to this question as there were a number of reasons for each answer. Interestingly more than one respondent said they were less than satisfied with their jobs because of the frustration of not being able to do more and because there was so much that did not get done.

Several professional and secretarial staff suggested they were more satisfied with their jobs because of the capabilities offered by office automation which included the ability to do their work better.

Some were dissatisfied because the job was uninteresting. Some secretaries whos' amount of time spent typing previously had been reduced drastically said they were less satisfied because of the lack of work to do.

AGENCY EFFECTS

Productivity

The motives organizations have to automate are some of the most common concerns on the minds of those currently studying office automation. Increased productivity is described as the primary force leading organizations to automate in the private sector, while little has been written about the motives of the public sector in adopting office automation. Almost without question the assumption is that the private sector adopts automatic in order to improve profit by streamlining decision-making, production, and delivery of a product.

Defining productivity in the public sector is difficult. Some may view it as better policy. Others may think faster response to public demands or political action is a measure of productivity.

One major "product" of government, at all levels, is service. At the local level, the cost and benefit of services can be measured and weighed. Water systems, sewers, police protection, street sweepers and the like are all services which are quite easy to justify. The same is true of services provided by states.

"Policy" in the realm of the Federal Government in some measure affects all citizens even though it may not be felt equally or at regular intervals. Government policy is often thought of by the average citizen as an intangible and frustrating network of laws, regulation, and established practice, confounding or aggravating. Some may even see government policy as subterfuge or manipulation. To the extent "service" can be delivered, one might say productivity depends on whether citizens feel policies are made in their interest or if they were fairly applied. The extent to which one can measure productivity of government and the impact of office automation on it, depends on subjective factors such as speed of response to impending or alledged harm, fairness of application or benefit, satisfaction of individual desires, reflection of collective will, or decisions made in the "national interest". As a result, some government productivity is reflected in delivery of services and some is the continual process of reflection and reconsideration of possible activities and functions government may undertake.

Obviously profit is not a major factor in public sector productivity measures. As in business though, cost of automation is a concern.

It is evident that measures of productivity and effectiveness in government and business are somewhat different. This difference in the notion of productivity suggests attitudes toward the acquisition of automated office systems may therefore be different.

Some government services are defined by automation. Our national defense would not exist as we know it without automation. Many government programs depend on automated systems to perform their function. Tax collection, Social Security, and similar types of government programs require massive record keeping capability. Levels of service the public has come to expect would be much different without computers. It may be argued that productivity in government is a matter of keeping pace with the increasing demands for service as new issues and areas of government interest arise. Automation has become such a pervasive fact of modern life that "services" such as telephone and bank accounts have recieved special consideration from the Supreme Court when considering the need to provide protection of individual privacy against unnecessary intrusion by law enforcement or others.

Development of office automation at USTR contains elements of both the need to provide greater service and the need to keep up with changing conditions.

The "product" of the Office of the United States Trade Representative is, at the broadest level, advice to the President regarding trade policy options and choices, serving as an "honest broker" between the many groups with an interest in government policy. Secondary impacts of that advice are reflected in tariff rates, quotas, jobs, foreign policy, prices of goods and services, and relationships with other countries. For the most part USTR is concerned with the analysis of various options in terms of what the policy of the United States should be when considering the secondary impacts.

Two recent cases, involving steel and automobiles illustrate what trade policy can mean. During the last several years, a great deal of political pressure had been brought to bear to try and protect a floundering domestic steel industry from less expensive foreign produced steel and steel products. Domestic steel producers sought relief in the form of higher tariffs and import quotas to allow time for domestic steel producers to recover from large losses. Even with the tremendous pressure, the administration held to its policy of stimulating competition and declined relief the industry was after. Analysis of the many political, economic, and socail factors by USTR, reflecting alternative impacts of various policies, aided the President in making his decision. The coordination function of USTR also aided in discussion of the issues among interested government agencies with their own concerns or those of particular a constituency.

Production of automobiles is another example of secondary impacts of trade policy. American manufacturers had asked for increased tariffs and import quotas on foreign manufactured automobiles. Again citing the beneficial effects of competition, Federal Government policy has been to limit trade sanctions to a minimum as long as some concessions could be won from foreign manufacturers. One such concession has been the establishment of foreign car manufacturing facilities in the United States to employ American workers back on the job, one of the greatest concerns of political leaders.

The most visible product of USTR, on a day-to-day basis is paper. Content of the paper, intellectual effort, is the product at the working level. Communication among and between interested parties is the next level of product and finally, national policy.

When measuring the effect of office automation at USTR therefore, one must evaluate fairly intangible products: coordination of discussion, interpretation of facts, analysis, and thought. Implicit in all is a need to bring together information from a variety of sources and the views of many interested parties, to aid in formation of a position. If the time taken to perform these tasks is reduced and the product improved by utilizing automated system over less efficient methods, one can argue that productivity has been affected. Clear measures in each case however, may not be readily apparent.

At the highest level, measures of improved productivity might include the degree of satisfaction of United States businesses who export and/or import goods and services in being able to get the government to address their individual or collective concerns and problems; the number and type of issues undertaken by the agency; whether it is able to serve industrial and agricultural interest both large and small; ultimately one measure must be the willingness and desire of Congress and the President to want to continue the present structure of trade policy formulation. It is likely that support for continued existence of the present structure could also be a desire on the part of other players not to disturb the status quo for fear of losing some leverage or advantage in the process.

At lower levels, measures of productivity might include the willingness of individuals representing business to devote time to the adviosory process or the willingness of other agencies to participate in discussions. What can be discerned from the interview results is that staff members believe the agency is doing more work after the introduction of office automation than before. Staff is better able to do their jobs and in a more timly fashion. As a result the agency is able to give greater attention to issues that come before it.

One of the most apparent examples of increased productivity at the working level is the electronic mail system. Because coordination of views on trade policy is one of the main responsibilities of USTR, the ability to get documents to staff in other executive departments who are concerned with trade issues for comment and clearance is an important aspect of each professional's duties. So important is this coordinating role that the Interagency Committee system is a part of the legal mandate of the agency.

Interviews at all levels of the agency revealed that the ability to send and receive documents by electronic mail to/from all concerned parties for comment and clearance has improved this aspect of the policy process. The Trade Policy Subcommittee Mail system allows USTR staff to send documents to members of any of 20 a Trade Policy Subcommittees. Respondents agreed that this system reduces significantly the time it takes to call meetings, discuss issues, and revise documents. Previously USTR had to rely on messenger services to hand-deliver and return documents in this process.

The system is yet 100% foolproof. Some of the problems keeping it from greater utilization include the lack of terminals for staff in other agencies, less reliance by other agencies on electronic capabilitiy, and "mail" never received because others fail to check their "mail box" regularly. Still, respondents suggested the time for review and clearance of trade policy positions and papers had been cut in half in some cases.

Responses to the question of how office automation has affected agency functions clearly reflect the feeling of all staff that office automation has had a positive impact:

Comments of Senior Staff

- Agency is better at convincing people of its position.
- Agency has a better understanding of the issues under negotiation.
- Agency has enhanced its ability to choose which subjects and issues to address as a result of being able to evaluate more of the information pertinent to the wide variety of issues.
- Staff productivity (output) has doubled; writing has improved.
- Less reliance on other agencies in the trade community for analytic support on issues.
- Greater self reliance with respect to analysis means agency exerts more control on the policy process.
- Automation has reduced the number of meetings that must be held for discussion or clearance.

- Time saving and being able to keep up with the development of issues enables agency to take advantage of opportunities and avoid potential problem areas.
- Before automation, issues in trade were prioritized on the basis of 1)political implications, 2) impact, and 3) whether the group claiming harm or asking for attention was large or small. Automation enables agency to monitor more information, understand interrelationships between many different variables allows agency to evaluate more issues from many quarters.
- Clearance, review, and comment on papers, cables, and memos is faster and easier aiding control of policy process.

Comments of Professional Staff

- Office automation has made trade policy system in general faster to act and react.
- Secretaries are freed for other duties.
- In one section, as a result of automation, a part-time positon was eliminated.
- Agency has adapted to expanded mandates without difficulty.
- Agency uses better data for its analytic work.
- Other agencies are slower to respond to issues.
- Assisting agency sections with requests for data and analysis is easier.

- Non-user sees 5% improvement in agency effectiveness as a result of automation.
- Ability to get cables to agency office in Geneva faster results in better trade policy as negotiators are clear on positions quickly with reduced confusion or conflicting information. Faster clearance of all types of documents results in trade policy better administered and implemented.
- Opposites in other (European) countries are amazed at speed of turnaround on offers and counter offers. Many had grown accustomed to long periods between communication often to stall action.
- Updating regularly used documents such as situation reports and briefing papers rather than redoing them each time, saves tremendous amount of time of professional and senior staff.
- Ability to manipulate and recall data makes policy choices clear, to both U.S. negotiators and staff and to opposite side.
- Agency is more independent or isolated from trade community (as a result of office automation), must make extra effort to communicate with others.
- Quicker reaction time to unforeseen events.
- Standard trade data base beneficial to entire trade community.

- Office automation has enhanced the reputation of the agency in the eyes of American business and U.S. trading partners.
- Complexity of trade environment requires great amount of information and system to manage it.
- Schedules of agency and other trade agencies are much different, automation assists in maintaining contact.

Comments of Secretarial Staff

- Work product of professionals is higher quality.
- Entire office runs smoother.
- Less stress as competition between professionals for secretaries time is reduced or eliminated.

Not all comments were positive however. One by a non-user pointed to some drawbacks to automation:

- Word processing results in the production of too much paper unnecessarily which, in turn, reduces agency effectiveness.

Other negative comments by senior staff included:

- Crisis management atmosphere still exists at times.
- Word processing makes work so much easier, more mistakes are possible.

Another possible indicator of enhanced productivity may be attempts to consolidate the responsibility of the USTR into one executive branch agency. This proposal might have come about at least partly because of the ability of USTR to enhance its effectiveness with office automation. Many other factors are undoubtedly involved, but the role of office automation should not be dismissed.

Organizational Changes

It is as yet impossible to relate hierarchical organization changes within USTR to the introduction of office automation. No major organization changes with respect to responsibility or reporting authority have taken place since the reorganzation of the agency in 1979, except for the addition of several senior staff positions. Since the introduction of office automation a number of established office relationships have been affected, especially between professional and secretarial staff members. As many USTR professionals have become accustomed to and proficient at drafting, revising, and producing for distribution, their own written work product, some secretarial staff have begun devoting more of their time to different work while others have become disatisfied with their jobs and the lack of challenged as a result of less responsibility.

USTR is a highly visible agency, with a great deal of public and official contact occuring daily. Much of that contact is by phone and secretarial staff are the prime conduit, whether it be screening calls for professional staff, responding to requests for information, or directing callers to the proper area for help with their request. Before the introduction of office automation to professional and senior staff, secretarial duties included heavy typing duties, frequently interrupted to answer phone calls. While demands for typing and answering phones are still heavy for some USTR secretaries, others find themselves spending more time on the later, making for less than satisfying or challenging work. As the office automation system at USTR becomes more famillliar to all staff members and utilization increases, one might expect secretarial staff to serve less in traditional secretarial roles and take on new responsibilities such as primary research and writing to assist professional staff in carrying out assignments. If that should occur, as it has in a few instances at USTR, one would also expect some secretarial staff to seek increased job responsibilities and pay. Because USTR is a small agency in terms of professional staff, opportunities for such advancement are be limited.

Relationships between senior and professinal staff may also undergo change as professional staff become more proficient at handling large amounts of information and become increasingly responsible for contact with others in the trade community on a daily basis. Organizational restrictions might inhibit dramatic organizational changes but one might expect higher rates of turnover at the agency as junior staff seek avenues of advancement through frequent contact and expertise in specific areas. Conversely, it is possible that senior staff, after having become more comfortable and familiar with the potential of the office automation system, assume more direct responsibility for day to day conduct of the operations of their various sections being able to carry out duties and responsibilities assigned to them with fewer professional staff.

Appendix A

SURVEY QUESTIONNAIRE

To: Office Automation Study Participants

From: Bill Neufeld, Study Director

The Office of Technology Assessment is conducting a study of the potential long-term consequences of office automation on organizations, people and policies. As a part of that effort, OTA commissioned several case studies to document some of the present impacts of office automation.

USTR was chosen as one of the organizations for study because of its unique efforts among government agencies at automating a number of different functions and activities.

Evaluation of office automation at USTR will proceed in two ways. First, the various steps taken in creating the existing system and plans for future development will be documented.

Second, the study will evaluate office automation from the point of view of the user.

Participants will be asked to answer a set of written questions intended to provide agency-wide measures of the impact of office automation in a number of respects. In order to capture each respondent's thoughts and opinions about office automation, the questionnaire is being administered orally. Participants are encouraged to add explanations to any of the answers to the written questions. The interviewer will also ask questions that arise from the written portion of the interview. The interview should last no more than 30 to 45 minutes

All responses will remain confidential. No answer will be attributed to any individual.

Thank you for taking part in this study. Any effort of this kind is impossible without the willingness of people to give of their time and insight.

Note: For the purposes of the questionnaire, "office automation" refers to all computer equipment and computer generated systems (software) available at USTR.

Date__________ Time_________

1. Indicate the number of times you use or access a particular function in an average week.

2. Indicate the degree to which you believe each of the following personal characteristics have been affected by the use of office automation at USTR.

   a. ability to do your job;

|_________|_________|_________|_________|

Much	Somewhat	Same	Somewhat	Much
Harder	Harder		Easier	Easier

   b. ability/desire to take on additional responsibilities, roles, and/or assignments, meet deadlines;

|_________|_________|_________|_________|

Much	Somewhat	Same	Somewhat	Much
Harder	Harder		Easier	Easier

   c. time spent creating/revising documents;

|_________|_________|_________|_________|

Much	Somewhat	Same	Somewhat	Much
Less	Less		More	More
Time	Time		Time	Time

   d. time spent on original research;

|_________|_________|_________|_________|

Much	Somewhat	Same	Somewhat	Much
Less	Less		More	More
Time	Time		Time	Time

   e. satisfaction with your job and working conditions

|_________|_________|_________|_________|

Much	Somewhat	Same	Somewhat	Much
Less	Less		More	More
Satisfied	Satisfied		Satisfied	Satisfied

3. Indicate how each of the following personal habits away from the office have been affected by office automation at USTR.

a. manner or method of commuting;

more time______ no impact________
less time______
commute in non-rush hours______
other_____

b. planning vacations or time away from work;

more time_____ no impact________
more flexibility_____
greater freedom to be away_____
other_____

c. time spent with family or friends;

more time_____
less time_____
no impact_____

d. writing for pleasure or professional development;

more time_____
less time_____
no impact_____

e. reading for pleasure or professional development;

more time_____
less time_____
no impact_____

f. amount of restful sleep you get;

more______
less______
no impact_____

g. health generally (blood pressure, smoking, eyestrain, back problems, diet, etc.);

better______
worse______
no impact_____

h. recreation
more time_____
less time_____
no impact_____

i. other factors__________
____
____

4. Indicate how each of the following personal work habits have been affected by office automation at USTR.

a. hours:
1. flexibility
more______
less______
no impact_____

2. at the office
more______
less______
no impact_____

3. on weekends
more____
less____
no impact______

4. at night
more_____
less_____
no impact_____

b. travel:

more______
less______
no impact_____

c. reading:

more_____
less_____
no impact_____

d. communicating with people:

-outside USTR: more_____
less_____

-inside USTR: more_____
less_____
no impact_____

e. use of telephone
more______
less______
no change_____

f. use of pencil & paper
more______
less______
no change_____

g. other factors____
____
____

5. Indicate how each of the following agency functions have been affected by office automation at USTR.

a. fulfilling its responsibilities;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

b. utilizing its resources (money & people);

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

c. exercising authority in trade policy

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

d. coordination of trade policy;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

e. setting and administering overall trade policy;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

f. conducting trade negotiations;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

g. responding to requests for information from the public;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

h. responding to requests from members of Congress and Congressional committees for information;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

i. responding to inquiries or requests from other government agencies;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

j. responding to trade intiatives of other countries;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

k. anticipating and planning for changes in trade policy;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

l. anticipating and planning for changes in international trading conditions;

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

m. number of international trade issues under consideration at any one time;

¦_________¦_________¦_________¦_________¦

Many Fewer Issues	Somewhat Fewer Issues	No Impact	Somewhat More Issues	Many More Issues

n. time spent studying each issue;

¦_________¦_________¦_________¦_________¦

Much Less Time	Somewhat Less Time	No Impact	Somewhat More Time	Much More Time

o. other activities/functions you believe have been impacted by automation:____________________________

¦_________¦_________¦_________¦_________¦

Much More Difficult	Somewhat More Difficult	No Impact	Somewhat Easier	Much Easier

6. Indicate the degree of responsibility you believe the the agency may gain or lose in the next five years?

|___________|___________|___________|___________|

Much less Resp.	Somewhat less Resp.	Same	Somewhat more Resp.	Much more Resp.

7. In a 1981 study, it was determined that, on average, 55% of the time of USTR secretaries was devoted to typing. What percent of your time do you estimate you devoted, in an average day, to typing before automated systems?

____

What percent do you estimate you devote to typing in an average day after the introduction of automated systems?

____

8. In a 1981 study, it was determined that, on average, 6 documents were submitted each day to USTR secretaries for typing.
How many documents did you submit/receive, in a day, for typing before the introduction of word processing equipment?

____

How many documents do you submit/receive now for typing?

____

9. Do you have a personal computer in your home?

yes______ no_____

If yes, do you use it for office work?_________

Did you have such equipment 5 years ago?_______

If no, do you plan to buy any type of personal computer equipment in the next year?_________

10. How would you rate your degree of satisfaction with your job?

Very rewarding_____
Satisfied_______
OK______
Not very satisfied______
Not rewarding______

11. Generally, how would you rate your attitude toward office automation:

o Before exposure to or utilization of USTR automation systems?

Favorable_____ Neutral____ Not favorable_____

o After exposure to or utilization of USTR automation systems?

Favorable____ Neutral_____ Not favorable_____

12. How were you trained to use USTR office automation systems:

by USTR staff______
by outside source_____
by other users______
trial and error_____
other____________________________

Appendix B

QUESTIONNAIRE REPONSES

1. Please indicate the number of times you use a terminal in an average week.

   Of those with terminals, 80% said they used their terminals everyday, 15% used a terminal once a week, and 5% used a terminal three times a week.

   There were no differences in response with regard to sex or level of responsibility. Older senior staff were much less likely to use the system than all others. Older secretaries were somewhat more reluctant to use the system than younger.

   Senior staff members used office automation the least, even those four of ten inteviewed with terminals on their desks suggested their use was sporadic.

2. Indicate the degree to which you believe each of the following personal characteristics have been affected by the use of office automation at USTR.

   a. ability to do your job;

      o 60% of the respondents believed that office automation made it much easier to do their jobs citing speed, ability to get more work done, and doing work better.

      o 24% said it made their job somewhat easier.

      o 12% said it had no impact.

      o 3% said it made it somewhat harder, citing increased amount of time to operate automated equipment over automated typewriter.

      Comments of Senior Staff

      - Final products of staff are better than before the introduction of office automation and require less attention during final review
      - Because secretary is faster, senior staff member is 33% faster and more efficient, work product is higher quality, more time for review, less tension and rush to get jobs done, easier to meet deadlines.
      - Work load of senior staff has increased because professionals turn work out faster causing flow of papers, cables, and letters for review and clearance to be more constant.
      - Less dependency on secretaries

- Word processing capabilities allows second thoughts.

- Failure to use office automation partly due to fear of machine.

Comments of Professional Staff

- More work gets done.

- Work gets done faster (on average, professionals estimated a 50% decrease in the amount of time required for routine tasks such as crafting papers, memos, cables, letters, revision, and final copies.

- Better at capturing thoughts

- Product is higher quality; writing is clearer and more concise.

- Office automation allows greater self direction and initiative.

- Less stress on the individual, between secretaries and professionals, office runs better as a result.

- Can see work done from start to finish; greater feeling of control.

Comments of Secretarial Staff

- Able to begin doing more analytical work using spreadsheet software; asked to help professionals with substantive work on some projects

- Printer is more accessible than copier, more freedom, control, and time saved with direct access to printer.

- Typing speed has increased; quality of work (fewer typing errors) has improved; keyboard touch is lighter; speller helps eliminate errors and corrections; ability to see entire document reduces number of mistake and corrections.

- Might turn down another job without word processing.

- PC requires too many steps to produce documents change systems (downloading/uploading from/to Data General).

- Job is less challenging.

- Reliability of system makes it slower than electronic typewriters.
- Software is not very flexible.

b. ability/desire to take on additional responsibilities, roles, and/or assignments, meet deadlines:

- o 90% of secretaries with terminals or PC's said it was much easier to take on additional reponsibilities or assignments because they were able to complete all of their work much faster, with less stress, and were therefore more willing to do more. 10% who believed it was only somewhat easier or no easier to take on additional work were those without terminals. Of those who felt that way and had terminals, it was because they felt they were doing as much work as they had before automation if not more. This was often the case when a secretary would be working with professionals without terminals and as a result would still be be relied on to do drafts of documents, revisions and corrections.

- o Professionals too were nearly unanamous in their belief that they were able to do more work. But none thought they had taken on additional roles and reponsibilites. Nearly all professionals suggested that they were better able to do their jobs and give more attention to many more details than before automation.

- o 75% of all respondents agreed that office automation made it much easier to meet deadlines, while 13% felt it made it somewhat easier, and 12% said it made no difference.

Comments of Senior Staff

- Office automation has not increased the amount of work there is to do nor the amount of work assigned to any invidual. What there is to do gets finished faster, more completely, and better.

Comments of Professional Staff

- No more work is created as a result of automation, work that is waiting to be done can be addressed. To the extent that staff is faster and better, they find it easier to do more of the work that is a part of their responsibility.

Comments of Secretarial Staff

- Work load has increased on those working with professionals without terminals, as the secretary has become faster.

- Always more work to do than time available to do it.

- Because of increased speed at completing work load, more time available to do more work.

c. time spent creating/revising documents;

- 70% of all respondents said it took much less or somewhat less time to create documents using office automation than before. 30% said that time spent creating documents was the same as before office automation. Of that 30% all were "non-users" of the system.

- 89% felt, however, that revising documents took much less or somewhat less time after the introduction of office automation. 11% said that revision time was the same.

Comments of Senior Staff

- Most senior staff said that they did not create many documents of any length. Most created only short letters, memos, or cables, relying on staff for more involved and lengthy writen material.
  As such they felt using pencil and paper was sufficien

- When reviewing documents prepared by staff, senior staff said they felt more comfortable making minor changes because they knew revisions could be made easily. With the pressure to pass on a final document reduced, they suggested the extra time gained provided the opportunity for "second thoughts".

Comments of Professional Staff

- Of all professionals who said that office automation had decreased the time it took to draft, revise, and produce a final written document each said they were 50% faster than before automation.

Comments of Secretarial Staff

- 95% of all secretaries with terminals or PC's reported decreasing the amount of time they spend on typing projects by 50%.

- Secretaries who work for professionals without terminals completed work faster and their work load increased.

- Revisions are much easier as professionals do most of their own drafting.

d. time spent on original research;

o 23% of respondents said they spent much less time on original research after the introduction of of office automation. 62% said they spent the same amount of time, saying too that they did very little original research requiring data or information bases before or after automation. 15% said they spent somewhat more time on research after automation because of time saved on other tasks.

e. satisfaction with your job and working conditions

o 60% of respondents reported being much more satisfied with their jobs and working conditions as a result of office automation, 30% said they were somewhat more satisfied, 6% said they felt the same, and 3% said they were somewhat less satisfied, mainly because of the failure of automation to live up to expectations.

Comments of Senior Staff

- As work is done better, senior staff derive greater satisfaction in the effort of the staff and the agency.

Comments of Professional Staff

- Still hopeful office automation can increase job satisfaction.

- Greater independence is more satisfying.

- Appreciates writing more after automation.

- Less stress on the individual; more individual confidence;work is more fun.

- Ability to complete work to individual satisfaction makes job more enjoyable.

Comments of Secretarial Staff

- Great deal of enjoyment working with the machinery (IBM PC).

- Previous job required aptitude test before working with office automation equipment which caused fear of equipment and capability, glad to see that wasn't the case.

- More opportunity to learn substance of work of the office.

- Job is more fun; less stress; people are friendlier; more individual privacy at a desk.

- PC is much quieter than mag car or selectric typewriters.

- More work done in less time; more personal satisfactio with work well done.

3. Indicate how each of the following personal habits away from the office have been affected by office automation at USTR.

   a. manner or method of commuting;

      - o 93% of respondents said that office automation had no impact, 6% noted some minor changes.

   b. planning vacations or time away from work;

      - o 79% of respondents noted no impact, 21% suggested that planning time away had become somewhat more flexible because their material was stored in a common electronic file that was standard and anyone needing access could get to documents much easier.

   c. time spent with family or friends;

      - o 69% reported no difference. 31% said that time saved not working after hours, weekends, or at home by being more productive at the office allowed them more time.

   d. writing for pleasure or professional development;

      - o 79% reported no difference. 21% said that they spent some more time because of less job pressure. One respondent said that office automation freed time to attend graduate school in the evenings.

   e. reading for pleasure or professional development;

      - o 79% reported no difference. 21% said they spent more time reading for relaxation as a result of time saved at the office.

   f. amount of restful sleep you get;

      - o 72% reported no difference. 28% reported that reduction in stress at the office helped them get more restful sleep.

   g. health generally (blood pressure, smoking, eyestrain, back problems, diet, etc.);

      - o 72% reported no changes in health generally. 28% reported feeling better because of reduction in stress at the office, the result of office automation, and better inter-personal relations.

h. recreation

- o 69% reported no difference. 31% said they took advantage of time saved to engage in more recreation.

4. Indicate how each of the following personal work habits have been affected by office automation at USTR.

a. hours:

1. flexibility

- o Senior staff, professionals, and secretaries said that hours were fairly well set by the large amount of public and official contact that goes on during business hours, primary among the necessities was answering phone calls.

2. at the office

- o The same was true for the amount of hours spent at the office. Some professionals suggested they spent more hours at the office to get work done so as not to have to take it home overnight or over the weekend feeling fairly confident of having things under control, by virtue of office automation.

3. on weekends

- o 75% of respondents said they did not come in on weekends before or after automation. 25% who did spend some time at the office on weekends before automation were there much less often after automation.

4. at night (overtime)

- o 90% of secretaries reported a reduction of overtime of 80% after automation. Professionals reported virtually no change in hours worked after 5:00 p.m.

b. travel:

- o Professionals reported no changes in the amount of travel after the introduction of automation.

c. reading:

- o Secretaries reported doing more office related reading partially as a result of time saved, less stress, rush to complete projects.

d. pencil and paper

- o 80% of professionals reported virtual abandonment of pencil and paper for drafting documents, letters, memos, and cables. Senior staff reported no difference.

e. telephone

- o No group reported significant changes in telephone use except staff who used electronic mail to other agencies to set up meetings, check on papers being received, or confirm approvals.

5. Indicate how each of the following agency functions have been affected by office automation at USTR.

a. fulfilling its responsibilities
b. utilizing its resources (money & people)
c. exercising authority in trade policy
d. coordination of trade policy
e. setting and administering overall trade policy
f. conducting trade negotiations
g. anticipating and planning for changes in trade policy
h. anticipating and planning for changes in international trading conditions
i. responding to trade intiatives of other countries

- o With one or two exceptions, respondents agreed that office automation had made all of the functions above, much or somewhat easier to accomplish or more effective.

Comments of Senior Staff

- Agency is better at convincing people of its position.
- Agency has a better understanding of the issues under negotiation.
- Agency has inhanced its ability to choose which subjects and issues to address as a result of being able to evaluate more of the information pertinent to the wide variety of issues.
- Staff productivity has doubled; writing has improved.
- Less reliance on other agencies in the trade community for analytic support on issues.
- Greater self reliance with respect to analysis means agency exerts more control on the policy process.

- Automation has reduced the number of meetings that must be held for discussion or clearance.

- Time saving and being able to keep up with the development of issues enables agency to take advantag of opportunities and avoid potential problem areas.

- Before automation, issues in trade were prioritized on the basis of 1)political implications, 2) impact, and 3) whether the group claiming harm or asking for attention was large or small. Automation enables agency to monitor more information, understand interrelationships between many different variables allows agency to pay attention to more issues from many quarters.

- Clearance, review, and comment on papers, cables, and memos is faster and easier aiding control of policy process.

- TPSC mail is not all that helpful because other agencies don't rely on the system. Other agencies and other countries have equipment not necessarily compatable making interconnection difficult in future.

- Interaction among senior staff has declined (not necessarily due to automation).

- Inter-agency discussions have declined.

- Crisis management atmosphere still exists at times.

- Word processing makes work so much easier, more mistakes are possible.

Comments of Professional Staff

- Office automation has made trade policy system in general faster to act and react.

- Secretaries are freed for other duties.

- In one section, as a result of automation, a part-time positon was eliminated.

- Agency has adopted to expanded mandates without difficulty.

- Agency uses better data for its analytic work.

- Other agencies are slower to respond to issues.

- Assisting agency sections with requests for data and analysis is easier.

- Non-user sees 5% improvement in agency effectiveness as a result of automation.

- Ability to get cables to agency office in Geneva faster results in better trade policy as negotiators are clear on positions quickly with reduced confusion or conflicting information. Faster clearance of clearance of all types of documents results in trade policy better administered and implemented.

- Opposites in other (European) countries are amazed at speed of turnaround on offers and counter offers. Many had grown accustomed to long periods between communication often to stall action.

- Updating regularly used documents such as situation reports and briefing papers rather than redoing them each time, saves tremendous smount of time of professional and senior staff.

- Ability to manipulate and recall data makes policy choices clear, to both U.S. negotiators and staff and to opposite side.

- Agency is more independent or isolated from trade community (as a result of office automation), must make extra effort to communicate with others.

- Quicker reaction time to unforeseen events.

- System may be too complex.

- Standard trade data base beneficial to entire trade community.

- Office automation has enhanced the reputation of the agency in the eyes of american business and U.S. trading partners.

- Complexity of trade environment requires great amount of information and system to manage it.

- Schedules of agency and other trade agencies are much different, automation assists in maintaining contact.

* Word processing results in the production of too much paper unnecessarily which, in turn, reduces agency effectiveness.

- Planning for changes in conditions involving international trade is not part of the responsibility of the agency.

Comments of Secretarial Staff

- Work product of professionals is higher quality.
- Entire office runs smoother.
- Less stress as competition between professionals for secretaries time is reduced or eliminated.

g. responding to requests for information from the public
h. responding to requests from members of Congress and Congressional committees for information
i. responding to inquiries or requests from other government agencies

o All respondents agreed that office automation made all of the tasks above much easier primarily because of the unusually large amount of correspondence the agency receives from business, Congress, and public for which the automated correspondance control system was designed.

Comments of Senior Staff

- Ability to keep track of all mail and requests for information and respond in a timely fashion is very beneficial, particularly being an element of the Executive Office of the President.
- Other agencies ability to respond to trade issues is bogged down because of size.
- Time to respond to requests for data and information has been reduced 50%.

Comments of Professional Staff

- Much easier for agency to respond to large volume of mail is important for control of trade policy.
- Being a smaller agency, individuals expect response to all inquiries and feel much freer to write.

m. number of international trade issues under consideration at any one time;

n. time spent studying each issue;

- o Both senior and professional staff agreed that office automation enabled staff to evaluate and analize issues of concern rather than expanding the number of issues. Some professionals did say that because they were able to complete their tasks more rapidly and to control all of the information surrounding a particular issue, they were better able to evaluate issues in much greater detail than before. Some professionals also described bringing other issues to the attention of superiors as a result. On the whole, however, office automation has not been responsible for increasing the number of issues. Senior staff see the agenda of issues set primarily by international agreements, events, and mandate.

- o Professionals and senior staff also agreed that there was somewhat more time available to spend studying issues in greater depth. One professional staff member was pushing herself to do more analysis and in fact was more interested in going deeper into a number of issues because of the greater amount time available.

6. Indicate the degree of responsibility you believe the the agency may gain or lose in the next five years?

   - o This question was included in the questionnaire to attempt to evaluate future requirements of office automation.

     - 5% of respondents, senior staff, professionals and secretaries believed the agency would gain much more responsibility in the next five years when considering the increasing importance of foreign trade and commerce in the world economy.

     - 65% thought the agency would gain somewhat more responsibility, and 30% believed it would remain about the same. Many believed that the ultimate test is related to attempts to bring the agency under the control of the Commerce Department, efforts begun in 1984 but defeated in Congress. Attempts to consolidate foreign trade policy into a new department of trade and commerce could surely expand the responsibilities of any trade representative but the agency would look quite different.

7. In a 1981 study, it was determined that, on average, 55% of the time of USTR secretaries was devoted to typing. What percent of your time do you estimate you devoted, in an average day, to typing before automated systems?

What percent do you estimate you devote to typing in an average day after the introduction of automated systems?

- o The time spent typing by secretaries ranged from 10% to 90% before and after automation (the same figure as found in the 1981 study) with an average close to 50%.

8. In a 1981 study, it was determined that, on average, 6 documents were submitted each day to USTR secretaries for typing.

How many documents did you submit/receive, in a day, for typing before the introduction of word processing equipment?

How many documents do you submit/receive now for typing?

- o As in question 7, the average number of papers either received or submitted did not change because some secretaries still did large amounts of typing for professionals without terminals while others did much less. At the same time secretaries with terminals who did as much typing as before in most cases did more because they typed and completed assignments faster.

9. Do you have a personal computer in your home?

- o 14% of those interviewed have personal computers at home. 86% do not. Half of those without terminals have computers at home while half of those that do have terminals have computers. One of those with a computer at home is a member of the secretarial staff and purchased the computer for her children.

10. How would you rate your degree of satisfaction with your job?

   - o 43% of the respondents said they found their jobs very rewarding; 34% said they were satisfied; 16% said the job was OK; and 4% said they were not very satisfied.

     In the last two categories were respondents from senior staff and from the secretarial staff. The senior staff respondent was less than satisfied because of the frustration of being unable to accomplish all that was possible in the position. Interestingly, he suggested the lack of office automation or of any suggestions on how it would help him do his job as the reason for part of his frustration. The secretary in this office had recently had an IBM PC installed at her desk but it was positioned in such a way that made access to the telephone impossible (the volume of calls in this office is the highest per day, in the agency).

     A secretary who said she was not very satisfied offered as her main reason, the failure of the office automation system to operate reliably.

     Other comments suggested less satisfaction with jobs even with office automation, because of frustration with the amount of work that was left to be done, even though more work was being completed with office automation.

11. Generally, how would you rate your attitude toward office automation:

   - o Before exposure to or utilization of USTR automation systems?

     Favorable 81% Neutral 9% Not favorable 9%

   - o After exposure to or utilization of USTR automation systems?

     Favorable 90% Neutral 10% Not favorable 0

     - o Responses to this question indicate that exposure to office automation has moved some people to be more favorably diposed to it than before.

     - o This response also shows the large amount of support for office automation before and after its adoption.

12. How were you trained to use USTR office automation systems?

- o All secretarial staff were given training on the word processing software, WordPerfect and the hardware, both Data General and IBM by two different vendors. Without exception all said that the sessions were more confusing and aggrevating than helpful. All said that the trainer seemed unable to teach nor relate the operation of the hardware and the software to the everyday operation of the office and their duties.

- o Most secretaries said that staff of the computer operations group provided the most helpful training they had received. Many secretaries said they learned the most through trial and error.

- o Two professionals attended vendor provided training and both agreed with secretaries that the session was not helpful. Other professionals said they relied on computer group staff and learning by trial and error.

- o Senior staff have not been offered any formal, hands on training course. They have been given an introductory course on the system as a whole and what it is intended to do.

Individual and Organizational Impact of Computer-Mediated Work: A Case Study

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Prepared for the
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PREFACE

This document describes how computer-based information technology was introduced into one white collar work setting, and explores the consequences to employees and the organization. The research extends prior work on information systems in varied user contexts, and illustrates factors that underlie successful technological innovation in organizations.

The project reported here relies on two lines of previous Rand research: studies of technology transfer and utilization and studies of organizational innovation. These lines of inquiry converge on the question of how technical advances can most successfully be translated into applied benefits. Recent Rand research on advanced information tools in office settings suggests the importance of implementation process characteristics for successful organizational innovation and provides the immediate context for this case study.

The study was supported by Contract No. 433-0045-L from the Congressional Office of Technology Assessment (OTA). It is one of four case studies funded by OTA to help evaluate the actual and potential impacts of new information and communication technologies in the workplace. OTA's investigation of these workforce issues was stimulated by requests from the Senate Labor and Human Relations Comittee and the House Education and Labor Committee.

This draft is intended for OTA use only. It will be integrated by OTA into a report to Congress. A revised and edited version of the draft will be published after OTA's report is released.

ACKNOWLEDGMENTS

We are indebted to our colleagues in several departments at The Rand Corporation (Behavioral Sciences, Information Science, Systems Science) for their suggestions and comments throughout this research project. We have also benefited greatly from formal reviews by Dr. Louis Miller (Chair, Rand Information Sciences Department), Dr. Robert Yin (Principal, Cosmos Corporation), Office of Technology Assessment research staff directing the study of Communication and Information Technologies in the Office, and representatives of the organization described in this report.

Most of all we wish to thank members of the participating organization who cooperated in countless ways with the research project. We took them up on their philosophy of open communications, and we learned a great deal from the experience.

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Vi

CONTENTS

DRAFT

PREFACE iii

ACKNOWLEDGMENTS iv

FIGURES ix

TABLES xi

Section

I. INTRODUCTION 1

Conceptual Framework 2
Research Design 3
Research Method 5

II. ORGANIZATION OVERVIEW 8

Physical Characteristics 8
Company Philosophy 16
Policies and Practices 18
Conclusion 19

III. THE IMPLEMENTATION PROCESS 20

Implementation Philosophy 20
The Business Problem 21
The Planning Effort 22
The Implementation Strategy 23
Departmental Incentives 25

IV. TECHNOLOGY AND TRAINING 28

Technology Overview 28
Technology in Four Departments 33
Training For Use 39

V. OUTCOMES 43

Impacts on Individuals and Groups 43
Explaining Success 51
Discussion 57

VI. References 59

Appendix A 60

Appendix B 67

References 85

DRAFT

FIGURES

1. Simplified Organization Level Chart, Company XYZ 10

2. Group-Level Organizational Chart, Marketing Research 11

3. Group-Level Organizational Chart, Planning 12

4. Group-Level Organizational Chart, Controller's Office 13

5. Group-Level Organizational Chart, Product Development 14

1B. Sample Histogram From Feedback Procedures 68

DRAFT

DRAFT

TABLES

1. Comparative Demographics in Four Focal Departments 15
2. Computer Systems, Databases, and User Departments 30
3. Computer Experience of Interviewees' In The Focal Departments 34

DRAFT

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I. INTRODUCTION

The 1980s are witnessing the rapid introduction of computer-based information tools into white collar work with dramatic technological change expected to characterize this sector for the remainder of the century (Drucker, 1981). The move toward the electronic office--long predicted--is driven both by technology push and demand pull. Technical advances (e.g., integrated circuits, fourth generation languages) have so increased processing power per unit of cost that most large and many smaller organizations are planning for or acquiring office computer systems (e.g., Walton, 1982). At the same time, costs for information handling work have steadily increased. White collar employees now constitute over half the U.S. labor force and account for $1 trillion, or roughly 70 percent of industry's annual payroll (American Productivity Center, 1982). However, growth rates for white collar productivity have decreased (Congressional Budget Office, 1981).

The congruence of technological opportunity and organizational need provides a strong impetus for investments in computer-based information tools. By some estimates, for example, 50 million U.S. office employees will be doing computer-mediated work by 1990 (International Data Corporation, 1981). With technical barriers now largely eliminated, there is a pressing need to investigate the social issues that accompany the widespread use of computers in white collar contexts. The aim of the study described here was to provide a detailed and comprehensive understanding of the organizational and individual impacts of advanced information technology in one white collar setting. Specific objectives of the research are to:

- Provide a picture rich enough to illustrate the kinds of events that computer system implementation may involve as well as creative approaches to coping with them.

- Use this picture to exemplify, in concrete terms, a conceptual framework that, we believe, underlies organizational innovation processes.

- Select characteristics from this organizational change effort that are probably related to its success.

Studying a successful case, we suggest, is important for two reasons. First, it is easier to learn from positive than from negative examples (and bad examples of computer system implementation are readily available). Second, even a single case is sufficient to disconfirm two commonly held but erroneous beliefs: that computer technology necessarily degrades work and deskills workers, or else that the economic interests of organizations entail these results. The case we have selected affords a quite different perspective, suggesting that alternative choices in managing technological advance can lead to positive outcomes for individuals and for the organizations in which they work.

CONCEPTUAL FRAMEWORK

Innovative technologies in applied contexts have formed the focus of much recent research (Tornatzky et al., 1983). Across varied subject matters and settings, highly congruent results have emerged. We therefore drew on this body of literature to develop a conceptual framework for studying computer systems in white collar work (Bikson, Gutek and Mankin, 1981).

The consensus from research in this field (e.g., Tornatzky et al., 1983; Johnson et al., 1983; Eveland and Rogers, 1980; Bikson, 1980; Berman and McLaughlin, 1978; Yin et al., 1976) is that technological innovation in organizations must be understood as a function of three components: the innovative technology, the context into which it will be introduced, and the process of embedding the technology in the context (the implementation process). Findings strongly support the inherent interrelatedness of these components. Moreover, it is the implementation process itself--a highly situation-dependent mix of events--that is most significantly associated with successful or unsuccessful outcomes of attempts to innovate.

These conclusions, corroborated by our own large-scale investigation of computers in private sector office settings, guided the design of this case study (Bikson, Gutek and Mankin, 1985; Mankin, Bikson and Gutek, 1985; Gutek, Bikson and Mankin, 1984).

RESEARCH DESIGN

For purposes of this research we defined a "case" as a geographically and operationally distinct organizational whole. By this definition, for example, the University of California and Xerox Corporation would not constitute "cases" but UCLA and Xerox North American Manufacturing Division would. The case we selected for study is the national headquarters for a medium-sized consumer product manufacturing firm. Its employees carry out all corporation-wide planning; in addition, they supply products to half the United States. The case, so construed, bounds the study we conducted and serves as the broadest organizational unit of analysis.

The organization, in turn, is viewed as the embedding context for work groups, or identifiable subsystems of organizations that have recognized purposes which unify their employees and activities ([illegible]ist, 1981). Any line department of an organization qualifies as a work group. However, this case study includes only white collar work groups, or organizational subunits for which information generation, transformation, or transmission are central activities (Bikson and Gutek, 1983). Four such groups were targeted.

Work groups, finally, provide the behavior settings for individual employees (Talbert, Bikson and Shapiro, 1984), who make up the smallest unit of analysis. Within each department, five employees representing varied occupational strata took part in the study.

Level-of-analysis issues in organizational research have been well examined elsewhere and will not be discussed here (see, for example, Katz, Kahn and Adams, 1980). We have assumed that an organization is a complex whole that requires analysis at multiple levels. Further, we underscore the importance of the intermediate departmental level for understanding how white collar technology effects work and workers.

- This level accords most closely with what is meant by an "office" both in organizational research and in "office of the future" literature (Bikson, Gutek and Mankin, 1981).

- Computer system applications are typically selected and implemented for subunits of organizations (Ellis and Nutt, 1980).

- Within any sizeable organization there is dramatic variation both in nature and extent of diffusion of innovative technologies among work groups (Bikson, Gutek and Mankin, 1981).

The context of innovation, then, comprises three levels: the organization, its work groups, and the individuals who staff them.

The new technology of interest is the computer system deployed to support a multiplicity of white collar tasks. Its introduction affords a common and visible event for delimiting this exploration. Specifically, questions about the impact of information technology have been temporally defined to refer to work changes and employee effects that have occurred since the first use of multifunction interactive computers by employees within work groups selected for study (Bikson, Gutek and Mankin, 1981; cf Yin et al., 1976). The departments in this study began to work online during 1980.

While properties of computer technology and the context of its use are viewed as important, we have given greatest attention to characteristics of the implementation process in this research. We began by assuming that the introduction of computers into white collar work is an adaptation process (Talbert, Bikson and Shapiro, 1984) involving social units at the three levels of aggregation described above. We define it as the sequence of activities--moving from symbolic (e.g., planning) to behavioral (e.g., training) and from early trials to changed work repertoires--that takes place between an organization's decision to acquire new technology and the technology's incorporation into regular operating procedures (cf. Tornatzky et al., 1983). Our aim was to learn about this process in one organization: how it began and evolved; who were the key actors and the roles they played; in what ways information technology is used; and what the consequences have been.

RESEARCH METHOD

So viewed, the process of implementing computer-based procedures in white collar contexts forms the focus of this research. We believe that case study is an important method for delineating and interpreting a contemporary process in a real world context--especially when the boundaries between the process and the context are not sharp, and especially when the variables of interest far outnumber the possible data points (cf. Yin, 1981). Exploring individual and organizational impacts of computers can be treated as that sort of effort.

The method we employed draws its general features from the implementation case study approach developed and elaborated in Rand's program of research on organizational innovation by Pincus, Berman, McLaughlin, Yin and others during the past 10 years. Semi-structured interviews constitute the primary data gathering procedure, supplemented by researchers' informal observations and archival information about the firm as a whole.

Selection of Respondents

Interview data were collected to represent the three tiers of the research design, with respondents distributed as follows:

LEVEL	INTERVIEWEES [number]
Organization	Executive Management [2] Personnel Department [1] Technical Department [2] Key Actors, i.e., other individuals who played key roles at the organization level in the implementation process [2]
Work Group	Department Heads [4] Linking Actors, i.e., individuals outside the focal work groups identified as links in the intra-organizational diffusion process [8]
Individual	Employees of Focal Departments [20]

Where possible, respondents were selected for participation on the basis of formal position in the organization chart (e.g., department heads). Others (e.g., key actors, linking actors) were identified during the data collection process. Interviewees were strongly interested in the research issues, and we encountered no refusals.

Construction of Protocols

Semi-structured interview protocols were administered to all respondents and required one to two hours to complete. The protocols were developed from a list of items about which we sought information--ranging from initial reasons for conversion to computerized procedures and how users were trained to subsequent changes in the nature of work and organizational performance impacts.

Questions in this item pool were then assigned to appropriate levels (organizational, departmental, individual) and role incumbents (e.g., executive management, linking actor, user). After all were assigned, we constructed protocols from sets of co-allocated items, with all items repeated in at least two. On that basis we generated six distinct but overlapping interview prototypes (Appendix A has a sample employee interview). Each focal department was assigned to one researcher for data gathering; other participants were divided approximately equally among the three researchers.

Data Analysis and Interpretation

Field notes taken during research visits were used to construct case reports for each department and for organizational actors; these then became the evidentiary base for subsequent examination. The interview protocols themselves served to structure analysis and interpretation, since responses to identical items could be compared across groups and levels in the research design.

Preliminary research findings developed in this manner were then reported to the participants in feedback seminars. These sessions served to confirm descriptive information, validate conclusions, and generate clarifying discussion around issues this organization faces as the technological innovation process continues.

Succeeding sections of this report describe the organization (Chapter II), the implementation process (Chapter III), the technology currently in use (Chapter IV), and its impact on users and user departments (Chapter V). The information in Chapters III and IV plus the first part of Chapter V draws exclusively from interview data. Chapter II also makes use of organization charts and other internal documents describing the firm. While these descriptions combine and paraphrase material from multiple sources, we have tried to stay as close as possible to the language of the respondents and to provide representative quotations as illustrative. However, to protect proprietary data and respondents' identities, we have used a fictional firm name and have obscured other information about the firm's structure and operations. The concluding sections of Chapter V fit these descriptions to the conceptual model of technological innovation outlined above and discuss their implications.

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II. ORGANIZATION OVERVIEW

To gain a better understanding of the context into which the computer-based procedures were introduced, this section describes the research site from three different but convergent perspectives. The first perspective presents the site in terms of readily identifiable and quantifiable characteristics. These "physical" dimensions include product, size, location, formal structure, job categories, and demographic properties. The second section presents the organization's philosophy and goals as expressed in company manuals, publicity materials, and handbooks. Actual written policies are summarized in the third section.

PHYSICAL CHARACTERISTICS

The research site is the national corporate headquarters for Company XYZ, a major manufacturer of consumer products. In addition to the headquarters office, the company includes four manufacturing plants located throughout the country. There are approximately 300 employees in the corporate headquarters and approximately 1000 employees overall. The company is a wholly-owned subsidiary of a larger corporation.

The study focused on four departments within the research site:

- Marketing Research -- provides information to aid long and short term marketing decisions
- Planning -- administers the planning process and manages overall logistics functions
- Controller's office -- responsible for accounting and financing
- Product Development -- responsible for developing and maintaining current consumer products.

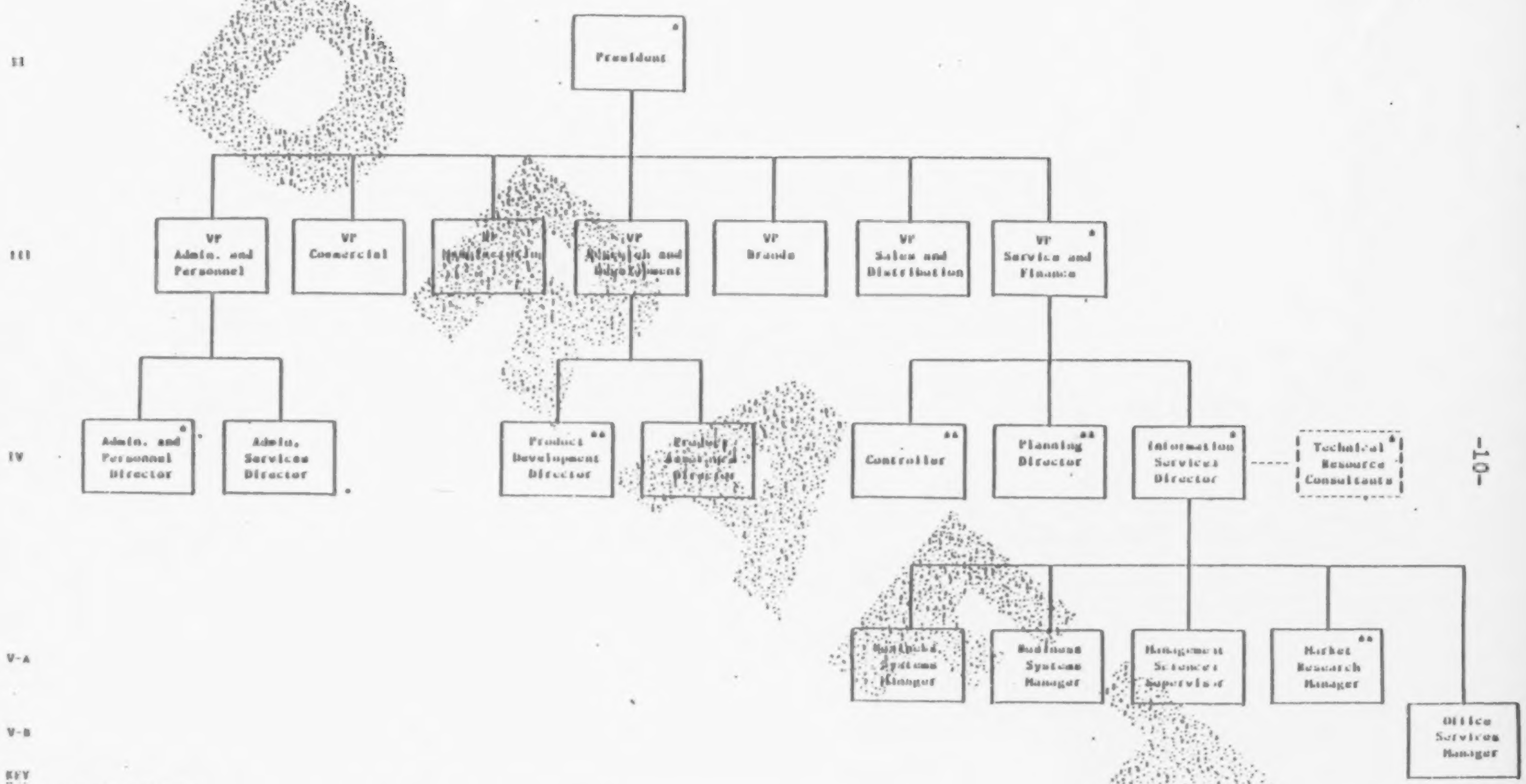
A simplified organization-level chart (Fig. 1) indicates the location of each focal department within the company. The chart also indicates the organization-level key actors who were interviewed. The row of roman numerals in the margin of Fig. 1 (and all subsequent organization charts) indicates the hierarchical levels defined by the larger corporation of which XYZ is a subsidiary. The President of the overarching corporation is at level I, the subsidiary presidents at level II, vice presidents at level III, and on down to level VII. Although Technical Resource Consultants (TRC) is not a part of XYZ, we have included them on the chart because of their close functional relationship to the firm. TRC has an on-site office and two of its employees served as interviewees for this study.

Group-level charts for each focal group are presented in Figs. 2 through 5 with all interviewees (managers and employees) indicated. Since the formal boundary of the Controller's office include several off-site employees (located in the manufacturing plants) who only interact occasionally with the headquarters staff, they were excluded from our definition of the focal group. The one exception is the Service and Finance Manager in Plant A who does have close contact with headquarters. Similarly, we defined the Product Development group to include only New Products and Core Business because of their high degree of functional interdependence. The boundaries for both of these groups as we defined them are indicated in their respective figures.

Table 1 summarizes demographic characteristics of the four focal groups as estimated by their managers, and of the company as a whole as estimated by the Director of Administration and Personnel.

A number of other features characterize this research site: little union involvement (only one of the four plants is unionized); high pay (in the upper quartile of comparable companies); and a high degree of career mobility. According to the Director of Personnel, all patterns of mobility occur--upward and lateral, within and outside the company, without one particular pattern predominating. This is also true for all focal groups except Planning. Employees in this group tend to move up to other departments in the hierarchy and remain within the company. Consequently, in contrast to other departments, none of the Planning Department members during system implementation in 1980 were still in that department at the time of this study.

FIG. 1--SIMPLIFIED ORGANIZATION LEVEL CHART, COMPANY XYZ


II
III
IV
V-A
V-B
President *
VP Admin. and Personnel
VP Commercial
VP Manufacturing
VP Research and Development
VP Brands
VP Sales and Distribution
VP Service and Finance *
Admin. and Personnel Director *
Admin. Services Director
Product Development Director **
Product [illegible] Director
Controller **
Planning Director **
Information Services Director *
Technical Resource Consultants *
[illegible] Systems Manager
Business Systems Manager
Management Sciences Supervisor
Market Research Manager **
Office Services Manager

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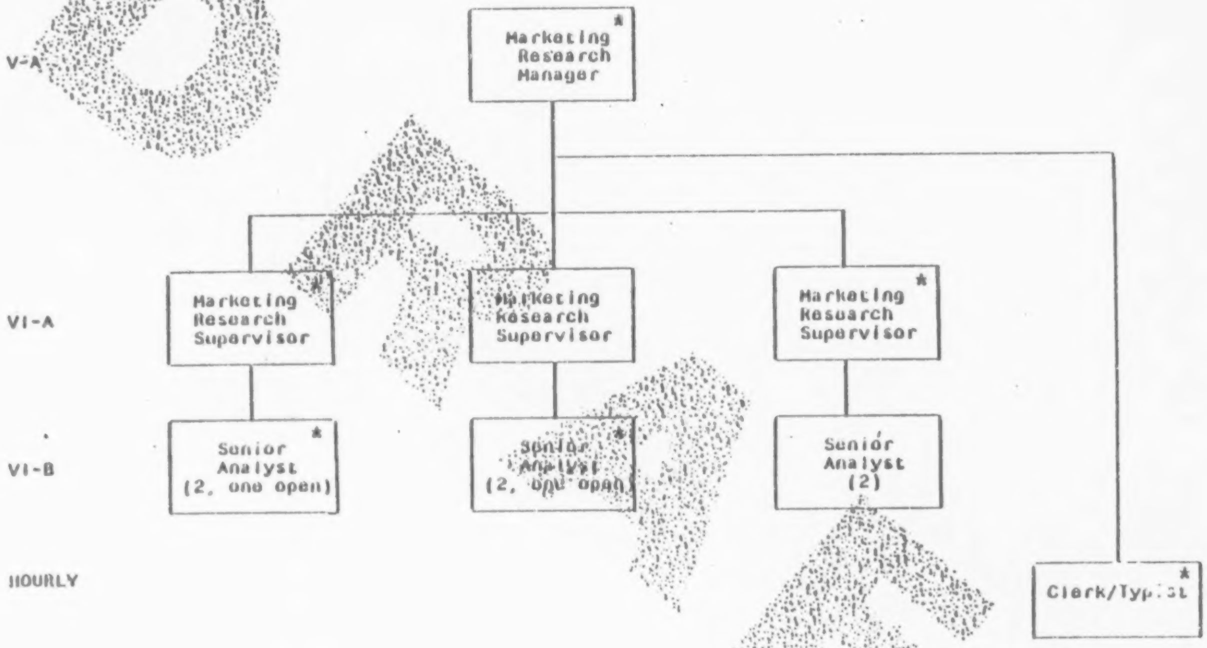
KEY
*Key actor interviewees.
**Focal groups (see group level charts for group structure and interviewees).
NOTE: Detail below level III is provided only when necessary to indicate key actor interviewees and focal groups.

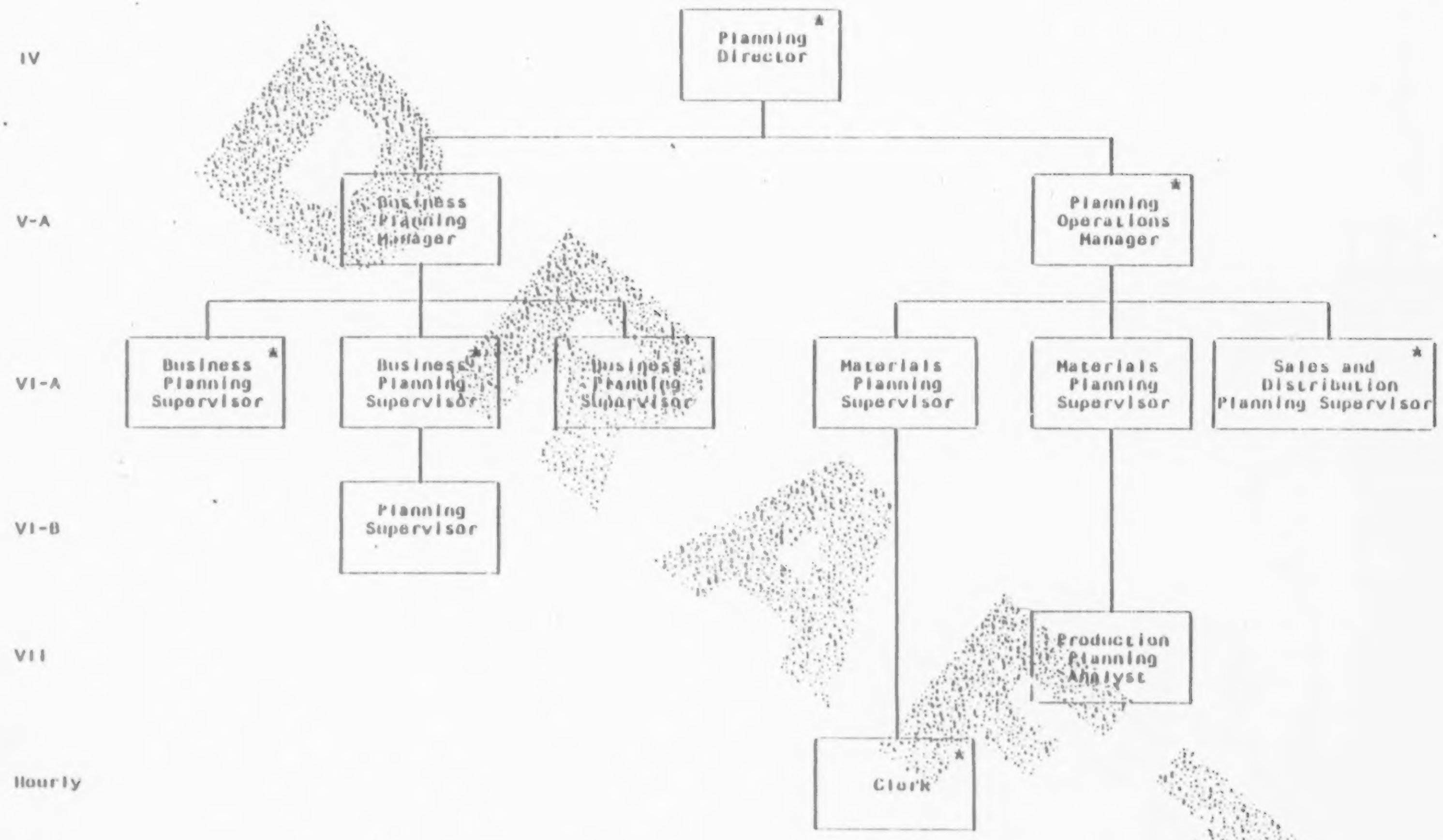
FIG. 2--GROUP-LEVEL ORGANIZATIONAL CHART, MARKETING RESEARCH


V-A
Marketing Research Manager *
VI-A
Marketing Research Supervisor *
Marketing Research Supervisor *
Marketing Research Supervisor *
VI-B
Senior Analyst (2, one open) *
Senior Analyst (2, one open) *
Senior Analyst (2)
HOURLY
Clerk/Typist *

DRAFT

KEY
*Interviewees
NOTE: Linking actor interviewees were in Sales Planning under Sales and Distribution.

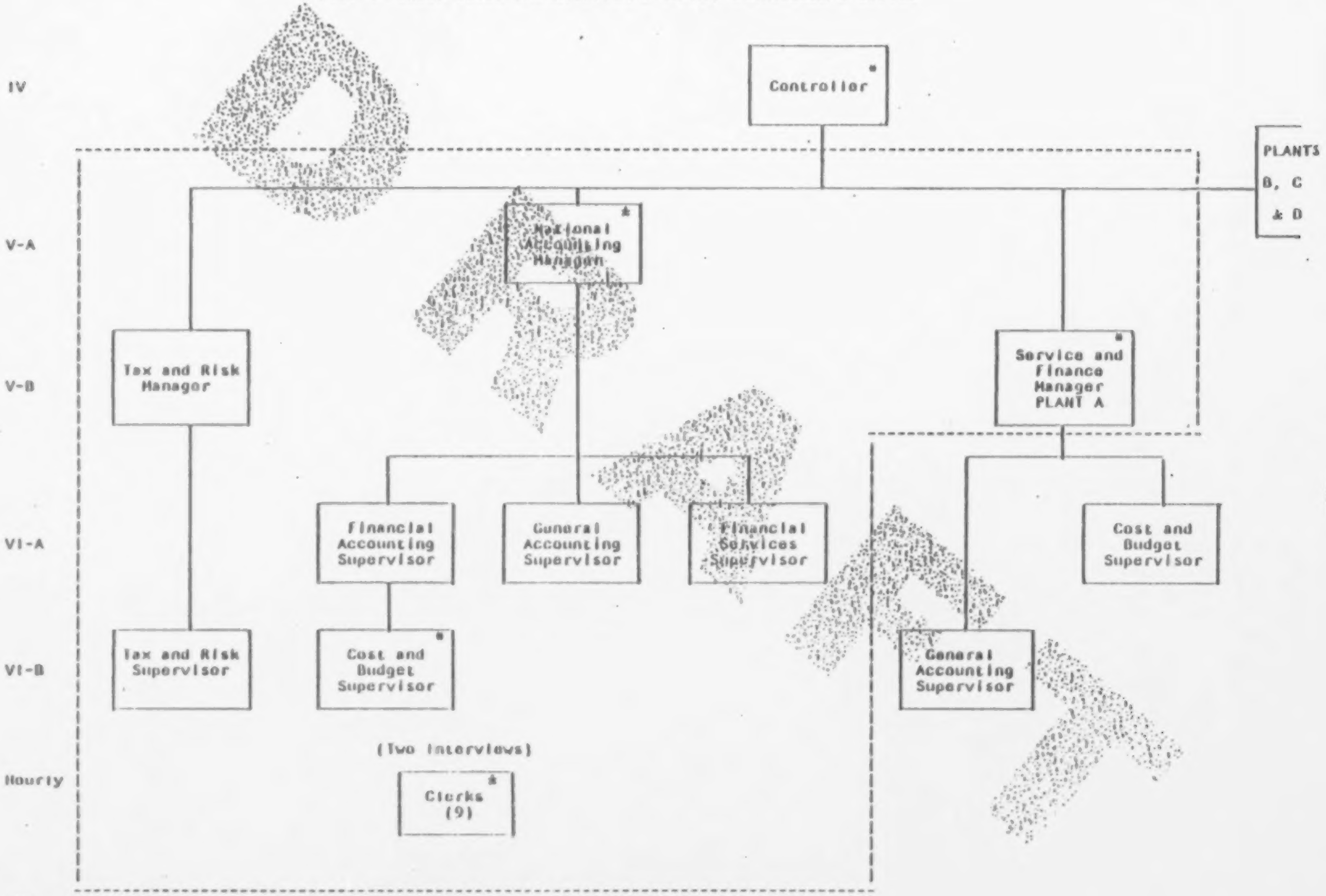
FIG. 3--GROUP-LEVEL ORGANIZATIONAL CHART, PLANNING


IV
V-A
VI-A
VI-B
VII
Hourly
Planning Director *
Business Planning Manager
Planning Operations Manager *
Business Planning Supervisor *
Business Planning Supervisor *
Business Planning Supervisor
Materials Planning Supervisor
Materials Planning Supervisor
Sales and Distribution Planning Supervisor *
Planning Supervisor
Production Planning Analyst
Clerk *

DRAFT

KEY
*Interviewees
NOTE: Linking actor interviewee was Marketing Manager in Brands.

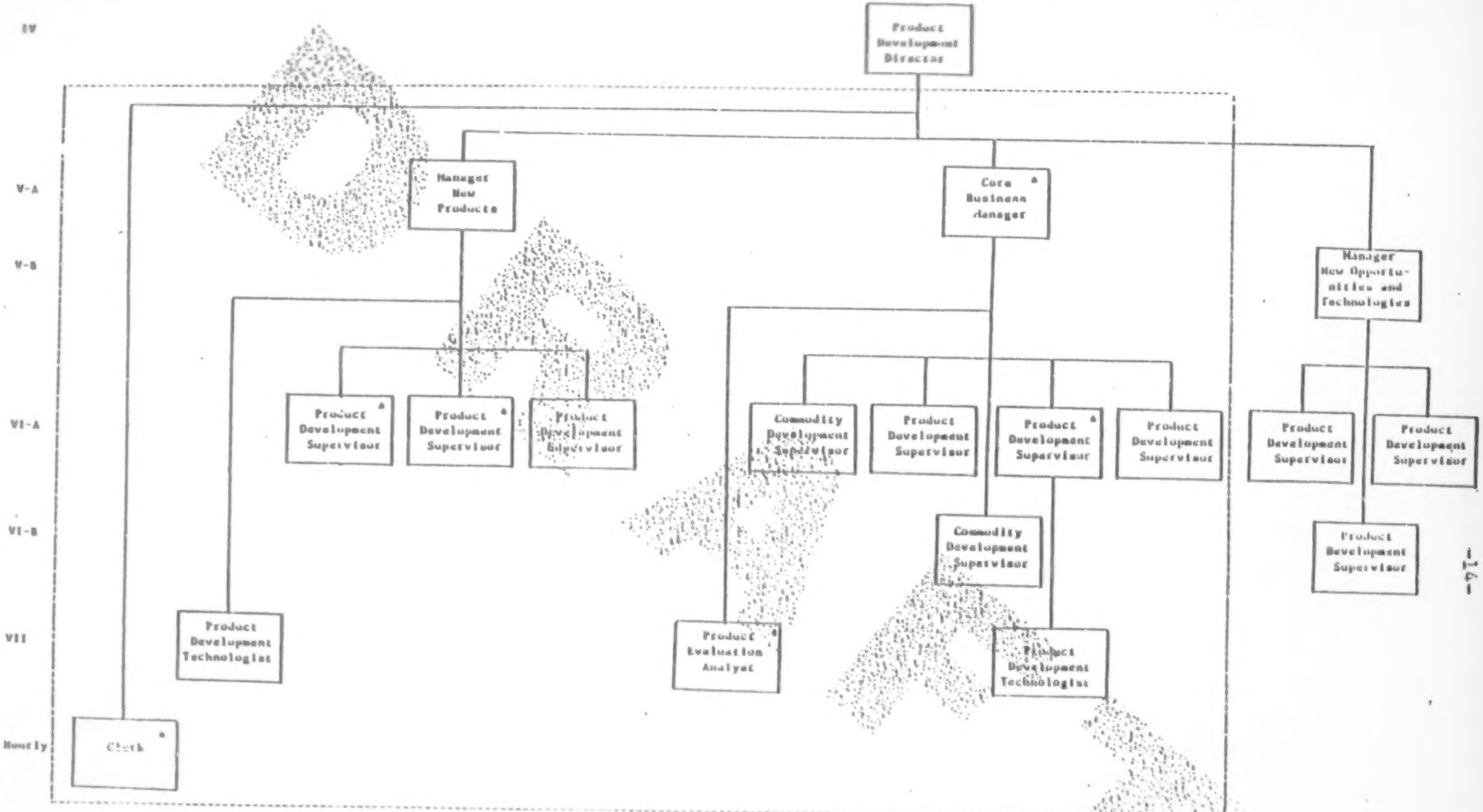
FIG. 4--GROUP-LEVEL ORGANIZATIONAL CHART, CONTROLLER'S OFFICE


IV
V-A
V-B
VI-A
VI-B
Hourly
Controller*
PLANTS B, C & D
National Accounting Manager*
Tax and Risk Manager
Service and Finance Manager PLANT A*
Financial Accounting Supervisor
General Accounting Supervisor
Financial Services Supervisor
Cost and Budget Supervisor
Tax and Risk Supervisor
Cost and Budget Supervisor*
General Accounting Supervisor
(Two Interviews)
Clerks* (9)

DRAFT

KEY
Boundary of focal group as defined in study.
*Interviewees
NOTE: Linking actor interviewee was Industrial Engineering Manager in Manufacturing.

FIG. 5--GROUP-LEVEL ORGANIZATIONAL CHART, PRODUCT DEVELOPMENT


IV
V-A
V-B
VI-A
VI-B
VII
Hourly
Product Development Director
Manager New Products
Core Business Manager *
Manager New Opportunities and Technologies
Product Development Supervisor *
Product Development Supervisor *
Product Development Supervisor
Commodity Development Supervisor
Product Development Supervisor
Product Development Supervisor *
Product Development Supervisor
Product Development Supervisor
Product Development Supervisor
Product Development Supervisor
Commodity Development Supervisor
Product Development Technologist
Product Evaluation Analyst *
Product Development Technologist
Clerk *
Boundary of focal group as defined in study.

DRAFT

KEY

*Interviewees

NOTE: Linking actor interviewees were a Senior Systems Programmer with the Technical Resource Consultants and a Credit Services Supervisor [illegible] Sales and Distribution.

Table 1

COMPARATIVE DEMOGRAPHICS IN FOUR FOCAL DEPARTMENTS

	Marketing Research		Planning		Controller's Office		Product Development		Company XYZ Overall	
	Hourly	Salaried	Hourly	Salaried	Hourly	Salaried	Hourly	Salaried	Hourly	Salaried
Sex (% Male)	0	50	[illegible]	91	33	86	0	62	10	75
Minorities (%)	100	0	[illegible]	9	33	16	0	8	35	5
Average Age	45	35	20-29	Mid-20s	25	30-35	22	35	40	40
Education Level (Mode)	High School	Masters degree	Bachelors degree	Masters degree	High school/ Bachelors	Masters	High school	Bachelors, but also 3 PhDs	High school	Masters degree
N	1	8	11	11	9	8	1	13	100	200

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COMPANY PHILOSOPHY

Understanding the company philosophy is important in understanding the impact of computers on this organization. Presented below are several excerpts from publications that give the company's views.

The first set of excerpts have to do with the company's expressed beliefs about the importance of treating employees well and giving them the freedom, opportunity, and rewards to perform effectively.

> "I feel like a real part of the XYZ team. And that sense of teamwork goes beyond just where we work. We all know that our business will grow and prosper only if it benefits everyone affected by it."
>
> "Working together has a special meaning at XYZ. We are striving to recognize and respect every individual's abilities, talents, and contributions."
>
> "I enjoy being with XYZ. I don't feel I'm a faceless entity in a big company. XYZ is an equal opportunity employer in the true sense. Opportunities are as tangible as they are equal."
>
> "XYZ seeks to attract, motivate, and retain above average employees with a total compensation program which recognizes responsibility, rewards performance, shares prosperity, and provides long-term security in the benefit program."
>
> "At XYZ we are developing an innovative style of organization. It's a concept that seeks to give employees greater satisfaction in their role by allowing them a good deal of self-management and a working environment they can influence. The result of this freedom is a collective commitment and involvement in the business."

A second theme is the importance of open communications

> "Our goal is to have ideas, information, and opinions flow freely so that there is a sharing of trust and understanding. We're constantly encouraged to express our views with any other member of the Company."
>
> "At XYZ our working environment is open. There are no private offices. Free communication is encouraged. This produces a climate and style highly conducive to productivity."

Viewing the internal functioning of the organization from a systems perspective is a third theme:

> "We view productivity in terms of a total system, embracing employees, equipment, machinery, and materials. Our success in manufacturing is due to the way these segments successfully interact."

A similar perspective also characterizes relationships with those external to the company. All employees are introduced to the "mutuality of benefits" philosophy at the time of their employment. This philosophy calls for mutually satisfying exchanges (e.g, goods, services, and money) with the groups they transact with on a regular basis.

> "We are a people-oriented company with a philosophy based on 'mutuality of benefits'. Our success is the direct result of our unique relationship with our employees, suppliers, distributors, consumers, and the communities in which we work."

Last, but far from least, there is a strong emphasis on innovation, risk taking and experimentation, and state-of-the-art knowledge and technology.

> "The XYZ Research and Development facility is one of the most sophisticated departments of its kind. Our team of specialists has accumulated an extensive bank of knowledge and has the support of a worldwide group of researchers in our field."
>
> "We're extremely proud of our Research and Development activities. It's this group that is directly responsible for our remaining at the technological forefront of our industry."
>
> "XYZ manufacturing facilities incorporate trained employees, equipment, and technology that have established us as one of the most progressive companies in our industry."
>
> "We are striving for an even more successful future--always willing to experiment, to innovate, to face new challenges with confidence."

In summary, the company views itself as people-oriented, open, and compromising an integrated system of individuals, technology and materials that is itself part of a larger system which includes consumers, distributors, suppliers, and the community. Innovation, experimentation, information, and state-of-the-art tools are also critical elements in the company's expressed philosophy, goals, and means. The extent to which these characteristics are exemplified in practice is addressed in the sections that follow.

POLICIES AND PRACTICES

The most noticeable and striking policies in this organization are those concerning punctuality. All employees, including the President, clock in every morning. Latenesses are counted and added to unapproved absences and, at a certain point, lead to warnings and possibly termination. On-site presence is regarded as important for effective interaction and communication.

It is important to reiterate that this policy pertains to all employees regardless of job level. Many employees mentioned this policy in referring to the egalitarianism practiced by the company, as well as expressed in its philosophy. Other practices that reinforce the impression of egalitarianism are the open office design and the first come, first serve rule for parking spaces.

Within each hierarchical level (Figs. 1 through 5) bonuses are linked to both sales volume and return on assets, providing an obvious incentive for improved performance for the company as well as for the individual salaried employee. Salary information is public within the company as part of its open information policy.

As mentioned above, there is at least an implicit policy to pay top dollar to hire the most highly educated and competent professionals and managers available. Educational assistance for the further development of their job skills is provided and employees are encouraged to take advantage of these opportunities. Lateral transfer from one department to another or from another subsidiary in the corporation is not uncommon and is generally perceived as an additional means for developing an employee's skills by providing him/her with a broad base of experience.

CONCLUSION

The impression that emerges from interviews and personnel data, together with company brochures and policies, is of a highly-educated, well-paid, largely professional workforce employed by a dynamic, innovative firm that recognizes the importance of its human resources. Except for its formalistic policies on punctuality, the company closely resembles the "organic" (i.e., non mechanistic) model of organizations that management theorists have touted for a number of years.

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III. THE IMPLEMENTATION PROCESS

A sophisticated and powerful array of electronic tools (see Chapter IV, below) was successfully introduced into an organization whose employees five years ago relied on a very traditional mix of information resources. Describing the sequence of decisions and actions that intervened--the implementation process--is the aim of this section. It first reviews the broad implementation philosophy at Company XYZ relying directly on the CEO interview. Then it details the strategy by which this philosophy was enacted, making use of material from interviews with a number of organization-level actors including the CEO, the head of the first implementation planning effort, and technical resource consultants. The chapter ends with a comparison of how these events unfolded from the perspective of the four focal departments, incorporating material from managers' and employees' interview responses.

IMPLEMENTATION PHILOSOPHY

In 1980 XYZ acquired a new chief executive officer who had a vision of the critical role for information systems in organizations, a vision that ties implementation success to broader organizational success. In the CEO's view, "success" can be equated with performance improvement. Performance improvement, he believes, usually comes from looking back at previous experience, manipulating and analyzing it in various ways, and ultimately learning from it. The key question is how information systems help, apart from whether they make use of computer technology.

An examination of familiar and admittedly useful information systems is instructive, according to XYZ's president. Closed systems like those used in accounting, for example, provide structures for recording financial events and getting immediate feedback about their effects. Open systems, as case law illustrates, likewise provide systematic ways of documenting events and thinking about them by way of analogy or precedent. In such very different instances, the CEO argues, having an information system is what permits retaining experiences, structuring and reasoning about them, and learning from the results. What computer technology can contribute is the capability to carry out these activities better, faster and easier.

A successful organizational information system, the CEO contends, should permit a business to do those very things--to collect, store, structure, and manipulate information about previous experiences in order to learn from them and improve business performance. This vision became codified as GROWTH THROUGH INFORMATION, EXPERIMENTATION, COMMUNICATION, and permeated the implementation process.

THE BUSINESS PROBLEM

While an overarching philosophy guided the implementation process, it was motivated by a serious business problem. The segment of the consumer product industry in which Company XYZ operates is highly competitive, with many strong players. In 1980 XYZ, holding fourth place among its competitors, was facing major profit-and-loss difficulties; it needed to increase market share and cut costs. This impetus, given the presumed role of information systems in business growth, led to an investment in computer technology.

The goal was to replace old, rigid, batch-oriented information systems and manual technology with flexible cutting-edge electronic tools, and concurrently to give users a renewed sense of power, insight and enthusiasm about their tasks, so as to improve organizational performance. This aim had a number of important corollaries. First, demand pull--business need--rather than technology push would motivate system decisions. Second, the desired systems had to be good tools, both for doing and for learning. That is, the system needed to be manipulable by users, who would pose questions, observe responses, and make judgments by modeling the relationships between them. Third, the technology should augment the worker rather than automate the work. Being able to ask good questions, do insightful analyses, take the initiative, and make a decision are emphasized as distinctly human skills that computers can assist but not replace.

THE PLANNING EFFORT

A high level organizational actor (now a Vice President) was named to lead the planning effort and put together an implementation team. He chose employees who had substantial business experience and a strong sense of strategy, and who--like himself--were not systems professionals but were comfortable with information technology. In addition, he recruited for the team an employee from another firm with recent systems implementation experience. Team members--in The Business Systems Department--collectively represented a knowledge of the organization's major business activities.

The 5-person team produced a business systems plan by first studying the work of the firm's many departments and trying to determine what sorts of information needs they had; this task required substantial input from department employees. Then it investigated the kinds of technology that might fill these needs. For this effort, the team relied heavily on advice and consultation from Technical Resource Consultants (TRC), an outside firm providing technical assistance for business systems development to several subsidiary companies in the corporate group of which XYZ is a member. Finally, in conjunction with TRC and user-department employees, the team developed a technical proposal that represented the completed business systems plan.

Looking back, the former head of the implementation team emphasizes the importance both of employee participation and technical expertise in the planning process. For answering questions about departmental information needs, he says, a direct knowledge of business tasks was critical. He contends that once a need is clearly identified, finding appropriate tools is not so hard; in contrast, making good decisions about tools when the task is unclear is impossible. On the other hand, scanning available technologies and making recommendations about what tools will best serve which needs required computer system professionals. For this purpose, access to TRC was extremely valuable. The implementation team was able to work well with TRC, in the view of XYZ employees, for two reasons. First, they say, TRC members are "bilingual"--both technically knowledgeable and skilled at talking with people who are not. Second, TRC operates on a market basis, unlike internal technical departments within firms; consequently it has a strong incentive to be highly responsive to the needs of implementing organizations who will otherwise take their business elsewhere.

THE IMPLEMENTATION STRATEGY

The year-long planning effort yielded an approved plan, and those who developed it were charged with its implementation. The team was given decisionmaking authority, continued access to employees and to technical resources, and responsibility for bringing in tools that worked relative to identified needs. In short, their job was to create a successful system. The implementation effort that followed was--and continues to be--an iterative process with a number of salient characteristics.

- Executive management was highly committed to the process and provided solid budgetary support. Its importance is evident in the apportionment of total systems expenditures to date:

10%	hardware
10%	software
30%	software development, modification
40%	implementation
10%	training

- The process operated on a project-by-project basis, with the plan partitioned into relatively independent parts. At any given time, the team chose a mix of some simple projects (easier, short-term) and some complex ones.

- The plan established a very general blueprint and performance criteria for system development but was indeterminate with respect to order of projects and details of their enactment. Each project undertaken required its own detailed design.

Projects originate either from user groups (who propose and justify them) or from TRC when it perceives a need it believes it can fill (if TRC initiates the idea, it must sell it to the user department). In any case, each project requires its own plan and justification; the implementation team reviews and acts on the basis of nominated projects. Both user groups and upper management estimate there is about an even balance between bottom-up and top-down project origination.

- Varied technical resources and constraints entered the process. A centralized computing facility operated by TRC enabled this mid-size firm to make use of more computing resources (power, storage, systems and expertise) than it could support on its own. Further, to more tightly link local users with technical experts, XYZ began in 1982 to retain an on-site TRC support staff.

  Relying on centralized external resources also constrained the company's autonomy. TRC, for example, chose the equipment, operating systems, and general utilities for its mainframe computer. Client companies such as XYZ must then choose hardware with host-compatible CPUs, storage media, and communications. On the other hand, client companies may choose any software that will run under the mainframe's operating systems (e.g. SAS), and TRC becomes responsible for maintaining and updating them.

  For many purposes, the constraints are not unduly limiting--especially given the proliferation of portable modular software. When these constraints pose problems, XYZ makes use of other alternatives. They may rent time on on other systems (see discussion of EXPRESS, below) for large computing needs not met by TRC. Or, for smaller tasks (e.g., project management), microcomputers may be purchased to fill the gap. If these options are chosen, updating and maintenance are handled in-house.

- Technological innovation was explicitly regarded as a process that entails experimentation and risk. It cannot be determined in advance exactly how new tools will work out--in many instances, employees found unanticipated and productive applications or generated valuable modifications. In other cases, new tools turned out not to be very useful and were discarded--managers estimate this happens about 25 percent of the time. These cases are not regarded as wasted expenditures or as failures. Rather, they are seen as part of the learning process that accompanies organizational advance.

- Finally, implementation was treated as a continuous evolutionary process aimed at a dynamic, organization-wide integrated information environment. This outcome was not assumed to be attainable in the short-term future, a perspective that had important implications. First, the system was designed for change, for continuous modification, extension and upgrading. This is coherent with the belief that there is not "a right answer" to systems questions, especially for an organization learning how to use new electronic tools as the technical state of the art is advancing. Second, the organization is prepared for change. It has not tried to

> impose suboptimal stability in order to achieve "postimplementation" equilibrium.

The project portfolio comprising the initial business plan will be completed during 1985 but systems development will continue, relying on the change mechanisms now in place. Viewed retrospectively, the implementation process to date is judged a success. Says the CEO, "No one in the industry is within 5 years of us."

DEPARTMENTAL INCENTIVES

At the broad organizational level there were explicit reasons for introducing computer-based information systems into the working life of its component departments. Interviews were designed to probe how widely and explicitly these goals were shared and what specific forms they might take within the four focal work groups. We found highly congruent incentives for adopting the new work technology at both departmental and individual levels. The theme was performance improvement, expressed in myriad ways throughout the firm.

For all participating departments, decision support was emphasized. Whether for production planning, marketing, product development or financial control, the installed information systems permitted them to carry out better analytic work than before, to make assumptions explicit, to experiment with the models underlying their judgments, to attain new task insights, and to base actions on wiser decisions. In addition, these groups found that online work allowed them to access more information as well as to integrate information from different sources, and to use information more flexibly. Further, they were all impelled toward system use by the timeliness and accuracy of data and by the savings in time and effort it promised.

Against the background of shared incentives, departments differentially emphasized different objectives. For example, improved timeliness is of special importance to the Controller's office for rapid payment processing and up-to-date budget analysis. On the other hand, flexibility is more strongly emphasized in Planning--particularly the ability to revise plans so as to avoid planning disasters. For Market Research more than for other departments the elimination of cumbersome paper- and microfiche-based procedures serves as an incentive. Finally, the Product Development department appears to have the most highly motivating application per se. A unique formula generation system allows them to work on product maintenance and product design in ways they could not before: they can, for example, model and observe formula-ingredient interactions; ask the system to suggest formulas that meet certain desired criteria; and respond rapidly to changed externalities (e.g., changed availabilities or prices of commodities) without risking product quality or consistency. New electronic tools have become almost inextricable from job functions in R&D.

These kinds of incentives were re-echoed at the individual level, where employees stressed high performance as intrinsically motivating. That is, the individuals we interviewed very clearly regard computers as tools capable of enhancing their performance and see that as the chief impetus for their use. As a subtheme, involvement with the technology for its own sake tends to be disapproved. It follows that the nature and extent of use of the computer is largely a function of individuals' judgments about what tools are best suited for their particular tasks.

In addition to improved job performance, however, employees mentioned a number of other incentives for using the computer system. First, users took pride in having attained new competencies--some were surprised by their own abilities, most found the learning exciting in itself, and in each department a few became teachers as well as learners. Second, many individuals cited the enjoyment of working in a dynamic information environment. The capability of an interactive system to support ad hoc restructuring of information, spontaneous pursuit of queries, and immediate inspection of the results adds interest value to tasks. Rather than increasing alienation, the system is perceived on the whole as putting users in more direct touch with the substance of their work. Finally, the system affords new avenues for individual-level experimentation and innovation--opportunities which everyone believes will, in the long run, lead to performance pay-offs.

From CEO to Clerk, then, there is the consistently expressed belief that computers enable people to tap into systems of knowledge and experiment with them for tangible benefits. Moreover, at all levels there is the conviction that this belief is being realized in highly individualized ways for the joint fulfillment of personal and group goals.

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IV. TECHNOLOGY AND TRAINING

TECHNOLOGY OVERVIEW

Computer technology at Company XYZ is both sophisticated and multilevel. A variety of hardware, from large IBM mainframes to personal computers, supports many different functions such as word processing, data integration and analysis, product decisionmaking, sales forecasting, and project management. The resulting information system is used by a multiplicity of employees at different skill levels. The term "computer system," in fact, is misleading: many separate systems operate in conjunction with other information technology, such as voice message exchange (VMX).

In this section, we first provide a broad overview of these systems, including the hardware, databases, and applications used by various departments. We also describe support mechanisms for these systems and treat other organizational-level issues and concerns, such as systems security. Next, more detailed descriptions of the systems and their uses in the four focal departments are presented. Finally, we discuss how training was accomplished for employees in these departments. We obtained information about technology and training from interviews with three technically knowledgeable individuals--a Business Systems manager and two employees in the outside technical consulting firm--plus managers and users in the four focal departments.

Primary Computer Systems

The computer systems and data bases used by the departments under study (both focal and linking departments) are summarized in Table 2. The major architectures include a remote IBM mainframe owned by TRC; Prime computer on which time is also rented; and a small number of personal computers. The systems on the IBM host can be conceptually separated into three general areas: Materials, Commodities and Ingredients (Materials); the Distribution Control System (DCS); and the General Ledger. Data bases on these systems are accessed and manipulated through a variety of operating systems (MVS, TSO, IMS), programming languages (e.g., FORTRAN, BASIC, Ramis, Script, Forsight, EXPRESS) and applications software (e.g., SAS, spreadsheets, graphics packages). XYZ operates in the IBM environment on a timeshare basis.

The Prime computer runs EXPRESS, a fairly high-level, matrix-structured language suitable for flexible data manipulation, analysis, and reporting, which supports decisionmaking.[1] EXPRESS is used to access both inhouse data, such as factory shipments, and syndicated data.

Further, some departments use personal computers. Databases are not regularly maintained on PCs, but analysts can download data from EXPRESS or from experimental product trials to PCs, which have better statistical and graphics applications. In the other direction, experimental data from the company's laboratories are entered onsite at PCs and uploaded to larger systems. Managers also have various administrative uses for PCs, which we will discuss later in more detail. In addition to PCs, field sales representatives use small portable computers. They can download data onto these and use them to make limited queries for demonstration and sales purposes when calling on buyers at retail firms.

Some systems are linked to provide different data to different departments. For example, the shipment data, which start in DCS, are periodically aggregated and sent to the Prime computer, where they are used by the Planning Department. Other shipment data may be downloaded to PCs used by the Controller's office. Interesting sales data, for example, may be used in the operations side of Planning to generate sales forecasts. While in EXPRESS format the data are used for production scheduling; the outputs are then reported to the manufacturing plant. The same data are used by the Planning Department clerk, who accesses them through the Gross Materials Requirements (GMR) system under TSO to produce GMR reports. Both the Product Development and Commercial departments subsequently make use of reported information about future requirements.

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[1] In popular literature, EXPRESS is called an interactive decision support system; it is more properly categorized as a flexible but highly structured end-user language.

Table 2

COMPUTER SYSTEMS, DATABASES, AND USER DEPARTMENTS

	COMPUTER SYSTEMS				
HARDWARE:	IBM			PRIME	PERSONAL COMPUTERS, PORTABLE COMPUTERS
	I. Materials	II. Distribution Control System (DCS)	III. General Ledger		
DATABASES:	Formulas Experimental	Orders Inventories Shipments Billing Traffic movements	Shipments Costs Accounts payable/ receivable	Shipments SAMI Burgoyne Distribution tracking Production scheduling	Individually created or downloaded as needed
USER DEPARTMENTS:	R & D Planning	Distribution Planning	Controller's Office	Planning Sales Planning Market Research	Controller's Office Brands Planning R&D Sales

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Looking at the systems used primarily by our four focal departments, we find that Planning uses DCS, Materials, and EXPRESS; Market Research uses EXPRESS; the Controller's office uses the General Ledger and PCs; and Product Development in R&D uses the General Ledger, Materials, and PCs.

Other Systems and Applications

In addition to these major applications, word processing is handled by a small centralized department within the organization. This group handles internal and external correspondence for various departments through their departmental secretaries.

Electronic mail is in use, but primarily for external communications to subsidiary companies. For a variety of reasons, electronic mail has not been fully implemented within XYZ. With help from TRC the company conducted two separate experimental trials with internal electronic mail; they first tried Burroughs E-Mail system, and the IBM PROFFS system. They found drawbacks to both systems and discontinued their use. Moreover, most employees don't have their own terminals, and even those who do aren't continuously logged on. Third, no one has been able to cost justify internal electronic mail. Finally, electronic mail is seen as hindering personal communications, which are essential elements of XYZ's business strategy.

XYZ does, however, use Voice Mail Exchange (VMX) to better manage telephone communications. Primary VMX communication occurs between sales representatives in the field and the Sales Planning department in the home office. Currently about 50 employees use VMX. The Information Services department is trying to solicit grassroots support in an effort to increase the use of VMX.

Systems Support

System support comes from two areas: the Technical Resource Consultants (TRC) mainly support IBM-based systems, while the Business Systems department supports non-IBM systems and coordinates the many different systems within XYZ. TRC operates a large IBM computing facility which serves XYZ as well as a number of other companies. TRC is responsible for supporting, updating and maintaining the major online systems at XYZ. Approximately 100 terminals at XYZ are now connected to the IBM mainframe (up from only 16 terminals three years ago).

EXPRESS, the major non-IBM system, runs on the Prime computer. Use of EXPRESS developed independently and experimentally within the Planning department as a special project and was later officially adopted by company XYZ. Although TRC consults and advises the company about non-IBM systems, major services for the EXPRESS system are provided by a vendor (MDS) and the Business Systems department. Business Systems' larger mission is to identify systems that meet business needs, to evaluate the costs/benefits of these systems from the corporate perspective, and to help make them a reality. Business Systems is also responsible for integrating the separate systems currently in use. One goal is to link the General Ledger to financial planning on EXPRESS. Another is to integrate inhouse corporate databases with syndicated databases. A third is to convert data used by Product Development into EXPRESS-readable form so that analysts can bring that high-level language to bear on their work (currently they use SAS, a more procedural language).

In addition to these major systems, PCs are finding their way into the company. At this point, their implementation is unsystematic, and neither TRC nor Business Systems has formal responsibility for their support. PCs are purchased by XYZ on employee request. In this way, the company maintains control over PC expansion. Although the company does not want to discourage PC use, there are concerns about data security--that is, the transfer of proprietary data from mainframe systems to PCs. They are also concerned about exclusivity--data maintained on a PC are not available for common use, in sharp contrast to XYZ's open communications philosophy. In sum, policies regarding PCs and their long-term use and place in the company are still evolving.

TRC and Business Systems both provide training and technical support. Both are responsible for training users on major mainframe applications. TRC runs a help desk at which users can ask questions about any company system. Users are then directed to individuals who can help them with their problems. Business Systems handles formal training and informal coaching on EXPRESS; employees usually take formal courses from the system vendor. Departments currently have responsibility for PC training and, within departments, de facto experts have informal responsibility to train peers on advanced or infrequently used applications. Business Systems provides a few PC-related services, such as downloading data from EXPRESS or helping interested employees locate PC training courses.

TRC and Business systems are also responsible for periodically updating databases within their respective systems. Other databases, which may be used by only one individual, are updated by that individual. The Sales and Distribution Planning Supervisor, for example, must update the Promotional database.

System Security

The employees we interviewed in both TRC and XYZ's Business Systems group were not aware of any data security problems. There is elaborate security to prevent "hacking" in the IBM environment, and EXPRESS users need passwords. Only a few people have more than read-only access to corporate databases. System security is, however, an important reason why the company currently maintains control over PCs.

TECHNOLOGY IN FOUR DEPARTMENTS

Below we provide a more detailed description of the uses of information technology in the four focal departments. We consider such issues as individual differences in experience and use, major applications, system availability and reliability, and users' overall assessments of their systems. We summarize this information across the four departments, highlighting similarities and differences.

Experience and Use

Computer use on the part of employees interviewed in these departments was highly variable. Table 3 shows the number of years, on average, that interviewed employees worked with computers at company XYZ. On average, employees had been using computers for at least three years by the time of the interview. Prior experience also varied by department, with employees in Market Research having most experience (see Table 3).

Table 3

COMPUTER EXPERIENCE OF INTERVIEWEES' IN THE FOCAL DEPARTMENTS

	Market Research	Planning	R & D	Financial Control
Mean Years Use At Company	3.5	2.7	4.0	4.3
(range)	(18 mos-3.5 yrs)	(14 mos-2 yrs)	(1-7 yrs)	(1.5-6 yrs)
Experience Prior to Job				
a) None/minimal	0	1	4	2
b) High school/ college	3	2	1	1
c) Other jobs	0	1	0	2
d) Both b & c	2	1	0	0

Across the four departments we found five employees who had their own workstations. The remainder shared workstations with two or more others. For some employees, the lack of workstations was problematic. One user mentioned "lots of fighting" to get on the system. Another reported coming in very early and organizing the work to be done in big blocks of time to insure continued access when deadlines approach. Consequently, this individual spends a great deal of uninterrupted time online. She takes breaks infrequently since it might be difficult to get back on the system. Still another had asked for his own workstation, but he has not received it because there's no room in his space. Other employees coordinated their work to accommodate sharing. This group of individuals work on the same tasks and are aware of their priorities; the person with the highest priority task goes first.

It appears that in most departments workstation allocation reflects task demands. In one department, however, status was also a factor in resource allocation. For instance, higher level managers can have PCs.

Lower level managers and professionals use public terminals to a host computer, logging in at the closest one available. However, there is some attempt to locate workstations where the need is likely to be greatest.

Actual time spent working on the computer was extremely variable across the four groups. In Planning, for example, one manager worked on-line only six days a year; one employee worked 2-3 hours every day; others might work on line every day for two months then not at all the next month. Individuals in this latter group tended to work 6-7 hours at a stretch when on-line. This variability was largely due to the nature of individual jobs and to higher work demands at periodic times (e.g., when end-of-period reports are due).

Applications

Because departments vary according to their mission in the company, it is not surprising that applications vary widely. Rather than summarizing across departments, then, we provide a brief overview of applications in each.

Market Research primarily uses EXPRESS to access and analyze data (e.g., consumer purchases, other sales data, factory shipments), and to write and format reports. Another system, with data on consumer buying behavior, is also accessed by the Market Research department on a timeshare basis through another company.

In operations Planning, EXPRESS is used for sales forecasting; employees examine shipments, promotional activities, and other historical data in order to project similar future events. EXPRESS is also used to input and analyze data that are not on-line, particularly on the business Planning side. One employee primarily used hard-copy data, but relied on EXPRESS for number-crunching. He was hoping to get more of his data on-line in the future. The Planning department clerk used EXPRESS-generated analyses to write Gross Materials Requirements reports.

TSO and IMS are major operating systems used by Product Development in R&D. IMS is a special system written for this firm; it is used for formula generation and material planning and control, and it accesses very large databases. The TSO operating system is time-shared and is used to run statistical analysis programs to support a number of other applications (graphics, word processing). Both VS BASIC and SAS run under TSO; SAS is used by most people in Product Development for their own analysis and experimentation. A number of other statistical packages are also available, which reduce the need for external programming resources. Finally, the department manager uses graphics and spreadsheets on the PC. These applications support project planning and tracking, and are particularly helpful for continuous modification of schedules and budgets, and for reconfiguring critical paths.

In the Controller's office, the software serves financial and accounting purposes. Within this general domain, applications range widely in terms of function, complexity, and level of skill required: from posting charges, reviewing customer accounts, applying checks to invoices in their accounts, and writing general ledger reports to financial forecasting, planning, and special analyses and decision support. This reflects the range of skills, job levels, and responsibilities of our respondents--from clerks to account managers.

The systems available to focal departments vary in their modifiability. EXPRESS is essentially user-guided; users can, for example, write programs to create models or perform needed analyses. In both of the departments with heavy EXPRESS use, employees took differential advantage of modification procedures. Some users write their own programs all the time. This allows them, for example, to customize reports through alterations in format, graphs, and title changes. Other users take existing programs and either use them as is or make slight modifications. It did not appear that the tendency to modify or write programs was necessarily related to experience or skill. Although one department "technophile" wrote a set of programs for the department to use, he had no more training or experience to begin with than did the employees who borrowed these applications. He enjoyed working on the computer and had become highly proficient at it. In Planning, where work is often deadline-driven, two employees felt there simply wasn't enough time to become more computer proficient.

The TSO operating system is both fast and flexible, and R&D users have a lot of control over the applications they bring to bear on their work. In contrast IMS, a system developed exclusively for company XYZ, is slow and cannot be user-modified (e.g., no customized reports); changes are expensive to make and may take six months. However, some large scale formula-optimization tasks can be better performed on IMS. Employees choose between the two systems depending on the demands of specific tasks. TSO, for example, is more adaptable to looking at small subsets of data in a particular way--such as effects of possible substitutions of ingredients in a formula. Once the choice between ingredients has been made, applications on the IMS system are used to optimize the final formula. While it varies from application to application, employees using these systems regarded them as essentially user-driven. Again, it appears that the extent to which users will modify the way the system behaves is largely a matter of their own needs, interests, skills and confidence.

Four of the five employees working with the General Ledger in the Controller's office described the system as essentially menu-driven. Although one of the four thought it was possible to "get around the menu," another claimed the menu cannot be circumvented. The only feature readily amenable to user modification is the Variable Report Writer, which allows users to access and format data in any way they want.

In sum, users in most departments have a range of options for guiding and modifying the systems they employ. On the one hand, this creates considerable choice about how to use the advanced tools. However, since these choices are left largely to user initiative, some employees envision a split between "haves" and "have nots", based on differential aptitude for information technology.

System Availability and Reliability

As mentioned earlier in the context of workstation availability, sharing workstations is problematic for at least some users in three of the four departments. Since few of these individuals use the computer all day, and their daily on-line work may be very limited, it seems reasonable that each does not have his or her own workstation. On the other hand, when a company pays top dollar for good people it also seems reasonable to provide enough workstations to eliminate person-time spent in waiting, sharing, and task-queing. The tradeoff, then, is one of cost versus access and has not been wholly resolved (see Appendix 3, Issue #8 for further discussion).

There seem to be few problems with system crashes or downtime. TRC usually warns the users of IBM-based systems about when a system will be down. Some problems were incurred with large-scale system crashes in the past, largely due to down connectors to the host computer thousands of miles away; the organization learned from these incidents and now has the necessary system back-ups.

On the whole, the EXPRESS system on the PRIME computer is also fairly reliable. Employees in the Market Research department noted some downtime problems, however, particularly during the two days per month when Planning is working on end-of-period reports. This creates an overload of users on EXPRESS. Employees in Market Research have to adjust their work to accommodate to this problem. In addition, downtime is usually a problem when databases are being updated.

Response time on EXPRESS is adequate to fast, depending on the number of users logged on. Slow response time is more of a problem on the IBM systems, especially during peak times. Users in R&D had most complaints about response time; one user estimated that he spent 30 percent of his computer time waiting. However, an R&D manager pointed out that these kinds of delays pose problems only because without the computer they would never have scheduled their work so tightly.

System Evaluation

Users across the four departments were generally enthusiastic about the capabilities of the computer systems. Users of both mainframe systems commented on their flexibility for manipulating, interpreting and reporting data, on the variety of applications available, and on the capability they provided to access up-to-date information.

Users in the Controller's office, Market Research, and Planning also had a number of specific complaints about the systems they use. For example, poor graphics capability, a mediocre statistics package, numeric computation, and difficulty moving between databases were cited as disadvantages of EXPRESS. Employees solve some of these problems by downloading data to and working on PCs.

Other complaints concerned the databases themselves. Data were sometimes inaccurate or unavailable, since on EXPRESS (for example) databases can only hold two and one-half years' worth of information. In addition, some employees did not like taking the time to maintain and update some of their databases. This task reflects the company's decision to distribute such chores among users rather than create repetitive data entry jobs.

Users in three of the four departments desired better integration between the major systems. R&D, for example, wanted to link the formula generator with the planning system, devise an improved link to the manufacturing plant, and create procedures for mapping large EXPRESS databases into SAS format for querying. Planning department users hoped for better integration between PCs and the General Ledger and EXPRESS databases.

By and large, the computer systems received kudos from most users. Interestingly, the disadvantages cited by users have more to do with lack of systems integration than with problems in the individual systems. Moreover, the integration problem had been recognized and, more importantly, planned for as an expected phase of systems implementation. That integration is an issue at all, and that its inevitability was anticipated, are important signs of the advanced stage of technology implementation in this company.

TRAINING FOR USE

Although we conceptualize training as part of implementation, we describe it after presenting an overview of the technology because it cannot be well understood apart from the information tools themselves. In this section we examine users' viewpoints on training as gathered in employer interviews. We discuss similarities and differences between departments on such issues as whether training was voluntary; the type of training offered; formal and informal learning support; and opportunities for long-term learning.

Voluntary or Mandatory?

Generally speaking, for employees below the department managerial level, learning about and using the computer systems is part of doing the job. However, learning anything beyond the minimum required for this purpose is voluntary. Managers in three of four departments were not regular users of the systems employed by their subordinates. Further, one supervisor was not a computer user; he had two analysts who supplied him with the information he needed. This individual asserted that learning to use computer systems was voluntary.

Structure of Training

The way training is accomplished varies somewhat by department. In R&D, the tasks are so specialized that general purpose introductory and intermediate courses (e.g., for using the text editor) are of little help. Further, since new employees enter infrequently, there are rarely enough people at the same level of learning at the same time to justify a class. So training proceeds on an individual basis, with peers. In the beginning a new user spends several days with peers, in on-the-job training. Peer learning also characterized the Planning department, where only one person uses a particular system. She was trained by the programmer who developed the system and by her supervisor.

Users of EXPRESS can attend formal classes offered by the vendor. Beginning EXPRESS classes stress concrete operations, and advanced classes include model-based understanding. Learners' perceptions of course goals were to get people to use the computer and to break down psychological barriers. Users were encouraged to experiment with their systems.

Finally, one employee, who arrived before classes had been initiated, learned about systems at XYZ on his own by reading manuals and asking for help when needed.

The amount of time required for users to learn their systems varied widely. In R&D it took 2-3 months for new employees to become comfortable using the main applications. In Planning, some applications could be used in just a few days, and users felt comfortable after about a month. The sales forecasting system, however, took about six months to master.

Formal and Informal Help

Across departments, users mentioned a variety of formal help mechanisms, including documentation (for both Prime and IBM systems), a technician for help on the IBM mainframe, a telephone help-line, the EXPRESS Users Group, and online help. These means of assistance, however, were not equally reliable. Employees had problems finding some of the manuals they needed, and some operations were not well-documented. Some interviewees regarded technical help, both online and in person, as too technical to be helpful for new users.

Informal support was crucial to most users in three departments. Two departments had EXPRESS "experts" who wrote programs for other users and provided regular training and technical assistance. A SAS "expert" in R & D judged that he spent about a half hour a day teaching or conferring with other users in the department about how to do something on the computer. These "experts" performed a voluntary support service; training and programming was not part of their job. In one department, users were asked not to rely on the "expert" so much, and he was asked to be less helpful. Many users indicated that their department "expert" was preferable to the technical people available through either TRC or Business Systems.

Long-term Learning

After initial training, users may take formal classes to increase their skills or learn informally by whatever means they choose. Advanced EXPRESS courses are offered externally; interested users can take them at the company's expense. When a new system is installed, users have been sent outside to learn it or have attended in-house courses. Furthermore, employees can request and usually receive reimbursement for any course as long as it is relevant to their job. However, few employees have taken advantage of this opportunity; some were too busy and others just hadn't gotten around to it.

Much long-term learning is informal and proceeds at the user's initiative. In R&D, for example, the learner must find someone who is willing and able to teach a particular task, and then find a time when they are both free. Other informal learning is planned and organized.

An employee in Market Research, for example, was informally trained as a backup for the department "expert" on the Prompt database.

Evaluation of Training

Despite the fact that training was a mixed-bag of formal and ad-hoc procedures, most users were well satisfied with the training support provided. Generally, EXPRESS has the best training and user support, because it has the largest user base. Support for other learning, such as the Ramis language, is harder to get, although there is a technical expert onsite. Users were not happy about the lack of PC support; it is too informal and very inadequate. One employee took it upon himself to train others interested in PCs. Another thought that the training function handled by Personnel could provide more PC support.

The assessment of training is more complicated from the perspective of experienced users who serve as teachers. For employees who do peer training, there is nothing in their formal job descriptions that takes account of this role--or in their official work schedules. They simply try to find the time to fit in user training or assistance, making trade-offs between what they have to do for themselves and what they believe they should do for others in the department. While they seem to enjoy the teaching role, they believe that learning support could be more effectively provided if some resources within the department were formally allocated for that purpose. A resource center was one suggestion for bringing some organization to the current catch-as-catch can approach.

In sum, training is eclectic and adaptive to the needs and skill mix of each department; how it proceeds depends on the task to be learned, the number of users who must learn it, and the resources on-hand or externally available. Beyond a minimum level, it is usually the user's responsibility to get the training needed or desired in order to do a better job. Department "experts" play a key role in this process, even though it is beyond their formal responsibilities. Although time for learning by formal means is allocated, time for informal learning and teaching is not (see Appendix B, Issue #11, for discussion of how training might be best handled).

V. OUTCOMES

In the interim report for this project (AR-3289-OTA), we described the nature of the work being done in the departments targeted for study and how it had changed as a result of computer use. The intent of this chapter is first to summarize the impacts of computer-based procedures for individuals and groups at XYZ. These accounts are based chiefly on interviews with managers and employees of focal departments plus linking actors. Then, using the conceptual framework drawn from prior innovation research, we suggest reasons why their introduction into the work of this organization has been successful.

IMPACTS ON INDIVIDUALS AND GROUPS

Probably the most important impacts to describe are those we did not find. We did not observe any trends toward the mechanization of work or toward the deskilling of jobs, in contrast to what has sometimes been experienced in other organizations. In fact, we generally found just the opposite--users in the main reported increased variety, challenge, creativity, and responsibility; these changes associated with electronic information tools necessitated the acquisition and use of higher skills related both to computer system competency and to new task performance. After summarizing important outcomes that characterize the experience of the focal departments and the organization as a whole, we discuss impacts that differ among the four participating groups. We give special attention to the identification of discrepant or negative experiences in this latter section, although responses in the main are consensual and positive. (Issues and problems are more fully explored in Appendix B.)

General Outcomes

Time savings was a universally reported impact of computer-based procedures for individuals and for groups. Most employees use the time gained through advanced information tools to take on new tasks and responsibilities (e.g., developing applications or helping others), and to do existing tasks better. Many have "reinvented" their work, as they discover new ways to use and apply computer technology. Some have invented new tools, for instance by developing programs that enable them to do a task more effectively. It is important to note that in the main the employees themselves determined the new responsibilities, tasks, applications and tools they needed to perform their work effectively.

On occasion, groups have also widened or redefined their missions as a result of computer use. The Market Research department, for example, now envisions its scope to include everything from the time they order the materials until the product is consumed, and has the comprehensive information tools it needs to support this broadened focus. The Industrial Engineering department, a plant-based group that frequently interacts with a focal group in the study, has redefined its mission to take in work "where the rubber meets the road." That is, making use of technical skills within its own staff, it is helping a focal department with PC implementation and training, filling a gap in support services. This function was too small and short term for TRC or for contracting to an external services vendor, so linking actors in Industrial Engineering stepped in to provide technical assistance.

In addition to "local" innovation on the part of individuals and groups, we also observed the development of significant "local" expertise. This expertise takes two forms. Most or all work group members exhibit a higher skill level, typically computer system knowledge that has been internalized and operationalized as a method of doing work. In contrast with having a technical department where all the expertise resides, expertise at wielding information tools for specific tasks is distributed throughout user departments. Some users, moreover, have developed especially high levels of technical knowledge which they apply to their own tasks and which they also apply to assist others. These are self-selected local experts, having become so at their own initiative. They act as trainers and technical consultants for others within their departments. In addition, they are typically the ones most actively reinventing the technology, developing and sharing special programs and procedures for their own and others' work (whether such in-house expertise is the best way to enhance systems is discussed further in Appendix 3, Issue #5).

The integration of competent workers and powerful tools in this manner has according to respondents, resulted in tangible performance improvements at the individual, departmental, and organizational levels. All the users we interviewed were able to cite gains which they believed were measurable (even though no formal assessments were undertaken). For example, some vital procedures (e.g., commodity balancing) required nearly a day when done manually and now require one hour. Moreover, as one employee pointed out, no matter how carefully and slowly the manual work was done, it was more likely to contain errors than the computer-based equivalent. Still others cited operations they were unable to carry out before (e.g., modeling complex phenomena) or did not do because they were too cumbersome if manually performed. Another mentioned doing work that would require three people without computer support. When asked about measurable performance gains, one employee summed up the general response to skeptics' questions about systems use and productivity by saying "if they can't see the difference they're doing it wrong."

At the department level, measurable group performance gains were likewise reported. For example, one manager emphasized time-to-project-completion as an area of demonstrable improvement. Informally comparing time-lines and milestones for projects of similar scope undertaken in 1979 (pre-implementation) and today suggests that the same types of efforts can be completed in much shorter periods. Another key indicator is capability to respond to exogeneous change. For example, using the online formula generator and experimental data base, the firm can rapidly alter its formulas and production plans to accommodate to or take advantage of unexpected changes in price or availability of raw materials. Competing product manufacturers, in contrast, cannot respond as quickly and be assured of continued product consistency and quality--nor could XYZ, prior to the implementation of an information system that provides flexible decision support.

Finally, organization level improvements are telling. In terms of bottom-line measures, XYZ has succeeded in cutting total costs per unit output, even though labor costs are higher. The firm has vastly increased the efficiency of its tools while retaining highly effective people. At the same time it is moving forward in market share. XYZ has achieved third-place rank and is closing in on second--it already surpasses the second-place competitor in product volume shipped and is not far behind in revenues. The most exciting organizational outcome, however, might be how well XYZ is positioned for "the information economy" of the 90's. It has become a truism that in the new economy, information is part and parcel of a business's commodities and services--if so, having a command of information technology should be a strong competitive advantage. While this thesis is difficult to understand concretely, XYZ has begun to actualize it. The wedding of information technology to business strategy is potentially the strongest organizational performance gain.

Group Comparisons

As we have indicated, the consequences of computer-mediated work were relatively congruent across departments and across levels of the organization. After extracting dominant patterns from the case reports (see AR-3289-OTA), we reviewed interview protocols on a question-by-question basis for differences within the impact areas at the individual or work group level. (Refer to Appendix A, pp. 69-73, for a set of employee impact questions.) Diverging responses are identified below. These potentially conflictual views were probed in more detail during feedback sessions conducted at the research site several weeks after the interviews were concluded; they are discussed further in the Emerging Issues Appendix (Appendix B).

Changes in Work. Reported changes in work were generally consistent across all groups. All said they were able to accomplish the same tasks in a shorter amount of time. The time savings were typically used to take on new responsibilities and projects, to do more technical tasks (e.g., training, programming), or to respond to increased demands for more of what they had done before and were now doing faster (e.g., more analyses, more reports). Increased control over work--due to such factors as more time and flexibility in scheduling, planning and performing their work, plus improved access to and ability to manipulate critical information-- was also widely reported, although there was more variability of response within Market Research. Total work demands increased for some and decreased for others, depending on goals and functions of the work group, design of the jobs, and they seemed to be more a function of the individual than of the job or department.

There were only two apparent and important between-group differences. One was a change in management style reported by the head of one focal department. The manager of this department was spending most of his time on-line and less of his time in more typical management activities (e.g., directing others). Opinions of interviewees in the group about whether this change was good or bad were mixed: one employee thought the manager was less accessible; others thought the manager was innovative and had a visionary approach in finding more and better ways to use the technology. The general issue of management style vis-a-vis computers--how much of their time should managers be spending online--was addressed in the feedback sessions. As these sessions revealed, the answers depend on what is needed for effective work group performance (see Appendix B, Issue #2). The related issue of the role of human judgment was also addressed in the feedback sessions and was resolved similarly (Issue #9).

Another between-group difference was evident in how users had invented new ways of doing their work as a result of the technology. Most interviewees in all of the groups reported tool reinventions. However, in some cases, interviewees were vague about the type of reinvention. In other cases, what they reported is more appropriately categorized as a new task or new responsibility. The level of tool reinvention (i.e., innovative adaptation or modification of the technology itself, in contrast to task innovation) was apparently greater in Product Development than in the other three departments. This may reflect the more highly technical nature of their work and skills. (See Appendix B, Issue #3 for further discussion of the impact of time savings on work changes.)

Changes in Communications. Most changes in communications resulted from tool sharing and interactions with others in the department related to getting help or informal training to use the computer, or to solving problems concerning a particular application or task. The only group that reported increased communications with those outside their department was the Controller's Office (plus one user in Market

Research). They have more communication with employees in other companies who use TRC's system and services. They also get more requests from employees in other departments for information about accounts, customers, and the like.

A particularly important interpersonal phenomenon was reported by Product Development and Market Research: the emergence of two potentially antagonistic groups, information system non-users and users, with different norms and values. This had not yet led to any actual divisions, but was a worrisome enough possibility to stimulate comments by several users. As a result this issue was also included in feedback sessions to determine how serious this problem might be and what its potential implications are (see Appendix B, Issue #1).

Few employees used computer based communications, and no one reported that they took the place of other forms of communication. Because of the strong emphasis on open communications and face-to-face interaction, many believe that electronic communications systems are unnecessary and possibly detrimental to intra-organizational behavior.

Could They Go Back to the Old Ways? In only two departments did any users indicate that they could go back to the old ways of working. In Planning two users believed it was possible to go back, but one preferred the new technology and the other only occasionally worked on-line. In Market Research, only one user would go back to the old way of doing things. In this person's opinion, the technology provided access to data not typically needed in more traditional approaches to market research.

Differences in Productivity. In general, all departments believed that productivity had increased as a result of the computers. Various manifestations of increased speed were the most frequently mentioned improvements--e.g., less time to do the same work, rapid access to critical information, and faster reaction to price shifts, commodity scarcities, and other changes in the business environment. As a result of the time savings, more data can be analyzed, more creative inquiries pursued, better decisions made, more reports (or drafts of reports) written; and it is easier to respond to changing conditions in a timely manner. Other outcomes mentioned included increased flexibility, quality, and cost savings.

However, one user in Planning felt that greater speed led to poorer quality because managers can pressure employees for more and faster work. Another view was that analysts were not as productive as they could be because of time they spend on data management instead of analysis. A user in Market Research similarly expressed concern that speed in data gathering might result in increased demands for data without increased demands for analysis. As a result, s/he felt the job had become more routine and less motivating, and these effects would lead to reduced productivity in the long run (see Appendix B, Issues #3 and #9, for additional discussion).

Physical and Psychological Impacts. Physical complaints were mentioned by at least two or more users in all four groups. The complaints included eye, neck, or back strain; headaches; sore fingers; dry eyes; and visual afterimages (with eyes closed) persisting after the end of the workday.

Stress was mentioned by users in two groups--Product Development and the Controllers Office--but no consistent cause or pattern was evident. Some of the reasons frequently cited include initial fear of the computer (which has since been replaced by confidence), or deadlines coupled with computer crashes, downtime, and slow response time. Finally, some users mentioned difficulty in concentration when a shared terminal is in use near their desk (see Appendix B, Issue #6).

Changes in Formal Job Titles, Descriptions and Levels. Formal job changes were reported in three of the four groups (Planning excepted), but only at the Clerk level. The two Clerks in the Controllers Office believed their recent promotions and pay increases were due to increased responsibilities and special assignments resulting from their computer use. The Clerks' job descriptions in Market Research and Product Development were being updated at the time of the interview, explicitly because of new computer-related and therefore, higher level skills and responsibilities. (In Product Development, that position has now been upgraded from an hourly to an exempt one.)

None of the salaried employees we interviewed has experienced nor expects to experience such changes in the immediate future, except to the extent that computers enable them to perform more effectively. They seem to view the computer as a tool for doing their work rather than an agent that changes the fundamental nature and functions of their jobs (e.g., analysts still analyze and managers still manage, although the ways in which they perform these functions may change). As the feedback sessions subsequently clarified, the determining factor should not be the technology itself but the degree to which the technology fundamentally changes the nature of the tasks and responsibilities (see Appendix B, Issue #4). The role of Personnel Departments with respect to these and other related issues was also addressed in the feedback sessions (Issue #12).

Changes in Job Satisfaction and Opportunities for Advancement. Increases in job satisfaction among most users were reported in all groups but Market Research. In the latter group computers were seen as a mixed blessing. While some users found self satisfaction and a sense of accomplishment from increased computer-related knowledge and improvements in the ability to do their jobs, others were bored, less motivated, and thought they were working below their abilities. Some dissatisfaction was also reported in Planning. Among the reasons cited were increased expectations about what the technology could do and, therefore, frustration when expectations were not met. Another user felt "locked to the terminal" when trying to meet end-of-period or other deadlines. Sources of satisfaction in the other groups included "I can do projects and not worry about the integrity of the data," a perception that management was now more open, the excitement of learning, feelings of achievement and mastery, and more stimulating and creative work.

Except as described with respect to clerks, few of the salaried employees interviewed believe that computer skills per se will or should lead to promotions and advancements unless these skills are actually tied to improvements in work performance. This view was strongly reinforced when the issue was discussed in the feedback sessions (Appendix 3, Issue #10).

EXPLAINING SUCCESS

As we indicated in the Introduction to this research, previous literature on organizational innovation provides a well developed framework for conceptualizing the factors likely to promote successful technology transfer and utilization. Using this framework as a guide, we have identified characteristics within XYZ representing its major components--the organizational context, the technology, and the implementation process itself--that we think help to explain XYZ's success.

Organizational Characteristics and Implementation Success

In most organizations innovation is constrained by bureaucracy, work process, and job design. In Company XYZ a conscious attempt was made not only to remove the constraints on innovation, but to encourage it actively as well. Three organization characteristics in particular, demonstrate their commitment to innovation.

First, it should be clear from the organizational overview that XYZ is *people-oriented*. That is, one of its most important tenants is that the fair and effective utilization of human resources is necessary for a successful organization. In practice, this means that they pay high salaries to attract top people and treat them well after they are hired. All are made to feel that they are an important part of the team, and superfluous trappings of status and privilege--such as reserved parking, private offices, different work schedule policies--do not exist.

Perhaps most important is the understanding that human resources, not technology, drive performance. They view computers as tools needed by competent and motivated people to perform their jobs effectively. When one manager was asked what rationale was used for implementing such extensive, diverse and sophisticated systems, he replied "the employees felt they needed these tools to do their jobs well, so the company went out and bought them." The technology is treated as a resource needed and used by competent people, whose work roles are not defined in terms of operating the technology.

The second characteristic is that the organization *knows what it takes to motivate* competent people. Specifically, they promote individual and work group autonomy, encourage initiative, and reward performance. One manager responded to the question, "How do you get people to be such self-starters, to be so innovative," by replying "They're allowed...If you let them, people want to do a good job, they want to be effective, they want to learn new ways of doing things." Other interviewees indicated that the organizational culture included a strong emphasis on innovation, self-motivation, and the opportunity for individual employees and departments to take on responsibilities and redefine their jobs as needed. Furthermore, employees felt that their initiative and performance would not go unrewarded (e.g., compensation policy ties raises to improved volume and return on assets).

It is important to note that these company policies and management approaches are consistent with some of the most widely supported ideas about employee motivation in the organizational literature (Lawler, 1969 and 1975; Lawler and Porter, 1967). First, for those who value challenge and autonomy in their work, good performance in jobs that have these characteristics is its own reward. Second, it follows that extrinsic rewards (pay, promotions) should be linked as much as possible to actual job performance. In other words, this line of reasoning recommends that organizations use people who take pride in their skills and responsibilities; give them challenging tasks and the opportunity to determine how these tasks are to be accomplished; provide the resources and tools they need to do their work effectively; let them know what is expected in terms of outcomes (i.e., performance and innovation); and reward the achieving of these outcomes with increased pay, promotions, and the like. The outcomes the organization desires will automatically follow. XYZ's management exemplifies these constructs and their implications for organizational policy, management style and job design.

The third characteristic is a strong *congruence between vision and action*, between strategy and practice. This is clearly apparent with respect to human resources, as should be evident by comparing the description on company philosophy (pp. 16-18) with the section on policies and practices (pp. 18-19) and the foregoing discussion. It is apparent in other significant respects as well, particularly with respect to the motto "Growth through information, communications, and experimentation." Interviews with employees at all levels continually illustrated the extent to which this vision permeates the organization and is manifest in the actions of individual employees. Constant reference was made to the key role of information in effective decisionmaking and performance. Similarly, the importance of open communications are emphasized, particularly with respect to sharing ideas and new ways of doing tasks, and helping each other learn and use the computers. Experimentation and risktaking were also frequently mentioned by employees at all levels. The overall impression was that--unlike many organizations with mottos--this organization was acting on its philosophy of information, experimentation, and communication. This philosophy was coupled with the human resources vision just described, and was used to guide systems development and its day-to-day application by employees. The philosophy and the degree to which it actually guides practice made XYZ a receptive and dynamic site for the introduction of new information and communication technologies.

Technology Characteristics and Implementation Success

The description of the computer technology installed at XYZ (see Chapter IV) makes clear that it is inappropriately described in the singular. It incorporates varied hardware and operating systems, numerous databases, and a multiplicity of software applications--both purchased and internally developed. As Kling (1983) insists, computer technology should probably be conceptualized more on the model of a web than a discrete entity. Given this complexity, it is difficult to single out characteristics of the technology that are probably related to successful implementation. However, empirical literature across domains of innovation provides a reasonable guide to such generic properties. XYZ's information system, we believe, strongly illustrates three second-order, generalizeable characteristics.

First, the technology is mission focused; substantive needs form the basis for computer system choices. This was evident both in the initial organizational impetus for investing in electronic technology and in the continued emphasis on technology-as-tool among users. In contrast, focusing on the properties of the technology per se, independently of their responsiveness to identified needs, typically produces implementation failures (Bikson et al., 1981). There is some evidence of that difficulty prior to the implementation effort we studied. One employee, for example, said that before 1980 there was support for using a computer but "there were no goals, nobody knew where it was going, and we did it on a shoe-string budget." Now, however, there is a clear vision of the role of information in the organization (see Chapter III and preceding section) that the technology reflects rather than determines. As a high-level manager put it, "That's why BUSINESS always comes before SYSTEMS in BUSINESS SYSTEMS."

Second, the technology is user driven. While it is highly complex, its operations can be guided, modified and manipulated by end users who had no prior background of experience with computer systems. Knowledge about how to exploit the system's capabilities can be acquired in stages, as needed, so that the technology affords a powerful and flexible tool kit. Frequently organizations opt instead for systems that are "idiot-proof" easy to use, impossible to interfere with, and requiring little learning. Such systems, however, are typically "competency proof," allowing no room for the exercise of users' skills. The choice of user-driven technology permits XYZ to take joint advantage of the full potential of interactive systems and substantively knowledgeable users.

Third, the system is designed for change. XYZ's policy in general is to provide its employees with state-of the art tools, but the art in this instance is rapidly advancing. Consequently the system, to be adaptable both to the emergence of new technology as it comes on the market and to extension and "reinvention" as users acquire greater expertise, has to be an evolutionary one. Many organizations, in contrast, aim to find the "right" system, install it, train to it, and never change it. Such an approach to system design makes the inevitable changes costly, difficult and turbulent. The XYZ system is, for the foreseeable future, in a development mode and not in a maintenance mode.

Implementation Characteristics

The conceptual framework guiding this research (see Chapter I) provides evidence that the quality of an implementation process itself will affect the quality of the results. For this reason we gave careful attention to describing XYZ's implementation process (Chapter III). Here we identify a number of characteristics of that effort which we believe have contributed to its success.

First of all, the organization in fact had a conscious implementation strategy. Most often, organizations introducing computer-based procedures give greatest attention to acquisition decisions and think very little about implementation issues. In contrast, at XYZ implementation had been carefully planned, staffed, and budgeted. As cost data reveal (Chapter III), implementation expenses accounted for the greatest proportion of total information systems expenses. Interestingly, our larger field research study (Bikson, et al., 1985) found that most organizations do not know what they spend on implementation since it becomes largely an ad hoc fire fighting effort not budgeted in addition to costs of hardware and software installation.

A second key feature is recognition of experimentation and risk-taking as elements in organizational innovation. Feedback sessions with employees established the experimental orientation as highly valuable in allowing user departments to try out new things and to get rid of tools that do not work out well. They emphasized, however, that trial and error learning about advanced technology requires nonnegligible budgetary commitments like other aspects of the implementation process. Nevertheless, as one senior level actor argued, "diversity is a good investment."

Creative tension between top-down and bottom-up system development is another distinctive aspect of the implementation process we studied. This approach attempts to balance centralized and decentralized decisionmaking so as to accrue the advantages of both. We use the term "tension" advisedly, since the two orientations emphasize contrasting goals: there is a drive toward centralized choices in order to evolve a system that serves the whole organization; and there is a drive toward user-based decisions since only they know what tools are needed. To avoid the tension created by such a dual orientation toward implementation, most organizations either opt for a unilateral approach (exclusively top down or exclusively bottom up) or else opt out (hire technical experts to do the deciding). XYZ instead attempts to unite top management support, technical expertise, and substantive user involvement. According to the CEO, maintaining a creative balanced tension (rather than destructive tension or one-sided imbalance) among these forces in system development is the most difficult part of the implementation process.

Next, whether an implementation project has been generated by the top-down or bottom-up approach, it will likely be characterized by a great deal of user involvement. Participative decisionmaking, with users and user departments having a strong voice, has two significant concommitants. This practice promotes system "ownership" by employees, who have a strong sense of responsibility for it and a commitment to making it work. Equally important, perhaps, it is a very practical way to link system design to substantive work needs.

A fifth implementation characteristic associated with its ongoing success, we believe, is adaptive training. Learning support is an eclectic mix that includes formal courses for commonly used applications, vendor courses on request, and peer training and technical assistance, informally supplied, by de facto experts on an as-needed basis. Training is thus function oriented, relevant to users' tasks, timely, self-motivated, and extends to very advanced learning. We underscore the importance of local long-term training resources adapted to specific user needs; without them, it is difficult for individuals to move ahead on the learning curve and become capable of increasingly sophisticated deployment of the tools to which they have access. XYZ's approach is an example of how mid-size firms (without large in-house training departments and scores of users at the same stage of learning) can provide training that will serve employees with widely varying needs and skill levels.

Finally, there is a characteristic which we call "organizational learning." As the account of the implementation process in Chapter III makes clear, there is no "post implementation" period. Rather, the information system continues to change and individuals keep finding new ways of working with it. New ways of working, in turn, generate needs for new system modifications or extensions, and so on. Instead of trying artificially to impose a steady state on the implementation process, XYZ is attempting to understand how innovation progresses. Rather than minimizing change, the organization has learned to manage it.

DISCUSSION

From our detailed exploration of computer systems as they entered the work life of one organization, we believe we have offered strong evidence for two conclusions.

- Information technology does not necessitate negative consequences for white collar employees; on the contrary, computer-based tools may be used to enhance workers and enrich information-related work.
- Neither outcome requires an organization to compromise its direct economic objectives.

The case we have studied, then, should help dispel the myth that technological advance cannot benefit both organizations and their employees.

At the same time, we believe XYZ's experience is illustrative of alternative ways to think about computer systems in information-intensive settings. First, it is important not to equate the implementation of computer-based information systems with the "automation" of white collar work--there is nothing necessarily mechanical or routinized about information-related jobs once they receive computer support. In fact, powerful interactive tools may demand greater skill, insight, creativity and judgment from users at all levels of the organizational hierarchy. Second, it is misleading to think that these issues are about computers, as if the technology somehow determined its own application. Questions about the consequences of computer-mediated work should be understood as questions about management policy and choice.

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As we have observed, there is a virtually limitless array of advanced information tools; organizational actors may select and adapt them in indefinitely varied ways. The characteristics of an installed computer system thus reflect an organization's values--organizations can choose tools that empower competent workers. Work design or redesign in relation to computer technology are likewise expressions of management philosophy. Organizations can choose not to define new jobs or restructure old ones in dehumanizing ways. Most importantly, perhaps, it is possible to build into the organizational innovation process itself features that are likely to preclude negative outcomes and promote positive ones.

In preceding sections of this chapter we described properties of the organizational context, information technology, and implementation strategy at XYZ that we believe are causally linked to observable positive consequences. Whether these findings are generalizeable to other settings is, naturally, a debatable matter that further research into comparable cases might resolve. XYZ is in many respects unique. Nevertheless, its employees think their experiences are not. When we posed the question of generalizability to the head of its implementation team he commented, "You know, five years ago I worked for a company that couldn't install anything and make it work--and it was XYZ." He believes that the same implementation strategy ingredients would yield similarly positive results for most organizations.

We too suspect that there is much to be learned from the XYZ example, essentially because it instantiates key elements of successful technological change--drawn from a growing body of empirical literature on organizational innovation (see Chapter I). However the policy recommendations implicit in this example are primarily for organizational decisionmakers in the private and public sector who are responsible for technological innovation within their own settings. Additionally, market forces might provide an incentive for organizations to emulate positive practices--practices advantageous to themselves and to their employees--once they are made public. Finally, government policy might play a role by devising economic rewards or disincentives to encourage the mutually beneficial deployment of advanced technology.

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APPENDIX A

Interview: Users

OPENING REMARKS

1. Introduction:

    a. Exchange of names (confirm interviewee's job title)

    b. Rand is studying the implementation of computer-based information and communication systems. We are exploring their impacts on individuals and organizations. Company XYZ was selected as a case study site because of the variety of ways its employees are using information technology.

    c. While Company XYZ as an organization agreed to participate in the research, individual interviews are entirely voluntary. Further, the interviewee should feel free not to respond to any particular question. Information in the final report will not be identified with specific individuals or organizations.

    Do you have any questions? Should we go ahead?

2. Organizational location:

    a. PLEASE SUMMARIZE YOUR JOB IN THIS DEPARTMENT.

    b. Explain that, in the main, questions are to be interpreted in relation to this specific department and job function. (There are no "right" or "wrong" answers--we want users' impressions and experiences.)

3. Technology orientation:

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a. We are interested in how the department has incorporated advanced information technology into its work. When we ask about the computer system, we are referring to your workstation and the major applications you use.

b. When we ask about changes in work and impacts on the department, we want to know what has happened relative to the user's work since he/she first acquired the use of a multifunction interactive computer system.

4. PROBES [FOR ALL TOPICS]:

   a. Expected (as well as actual) effects

   b. Differentiation of effects by sex, age, ethnicity, or job status

   c. Potential key actors not yet identified

IMPLEMENTATION

1. What was your department trying to accomplish in converting to online computer use?
(If productivity, efficiency or effectiveness are mentioned, probe for how they are defined or measured).

2. What incentives, if any, are there for you in working online?

3. Process overview: Were you here when this department first got access to interactive computer systems for regular work? [If not, skip to TECHNOLOGY section]

   a. Describe how, if at all, users took part in decisions about matters of hardware; software; implementation processes; the work environment; effects on employees.

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b. Overall, how well did the change process work out?

TECHNOLOGY

1. When did you first start using a computer here? ____________

2. Do you have your own workstation? (If not, how is it shared?)

3. Was this your first experience with computer use? (If not, note where else and for how long).

4. What are the major applications that you use? What tasks do you use them for?

5. When you interact with the system does the process unfold automatically, or do you guide the system?

6. Do you have any procedures for modifying the system (e.g., user-modifiable menus, user-definable keys, an end-user programming language)? If so, do you get a lot of use out of them? (Explain.)

7. Do you use computer-based mail? With whom do you mainly communicate? (Probe for informal as well as task-related communication.)

8. About how much time, in a typical day, do you spend working at a workstation? ____ (hours or % of total time). Is it continuous?

9. We're interested in any problems you may have with computer reliability or availability. For example,

   a. Can you easily get to use the equipment or software you need?

   b. Is the response time slow/adequate/fast?

c. Does the equipment crash or have a long downtime?

10. Overall, from your perspective, what works well in the system? What doesn't work well?

TRAINING

1. Now I'd like some information about training, from your viewpoint.

   a. Was learning to use the computer system voluntary for you and others in this department? (Probe: Does it differ for different users?)

   b. What's the main goal of the training program, as you see it? (Probe for concrete operations vs. model-based understanding.)

2. After initial training, about how long did it take before you were up to speed on the computer and using it regularly for your work?

3. Can you describe any formal follow-up support for using the system?

   (e.g, useful documentation, reference manuals, online help, whether error messages help the user correct his/her mistakes)?

4. What about informal support?

5. Long-term learning

   a. What are your opportunities for advanced learning and development? (Note whether employee has had any learning beyond initial training and whether he/she has or will pursue it oustside the firm.)

   b. Have you needed any additional training for new equipment or new software acquired by the department? (If so, how was it handled.)

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6. Overall, how satisfactory is the support for learning in this department?

IMPACTS: INDIVID/GROUP

1. Now I'd like to ask you about any changes in your work--the activities, what you do--related to the system. (Probe for expansion vs. constriction, and for redistribution of work).

   a. Changes in variety/variability?

   b. Changes in control over your work, especially in what is left to your own judgement?

   c. Do you have new tasks and responsibilities, or do you do the same job with a new tool?

   d. Have their been changes in job demands or work load?

   e. Changes in type of supervisory support? (Probe for machine pacing or monitoring of work.)

   f. Have there been any management innovations as a result of the technology (e.g., quality circles)?

   g. Have you or other employees invented new ways of doing your work as a result of the technology?

2. Have there been changes in communications, interactions, relationships among people here because of the computer system (describe).

   a. Do users share new ways of doing things,e.g. "tricks" they've discovered for getting around problems (probe for tool sharing)?

   b. Do computer-based communications replace memos, phone calls, in-person discussion, range of contacts?

   c. Has the quality or frequency or nature of interpersonal interactions in the office been in any way affected?

3. As of now, could you or other people in your department go back to the old way of doing things?

4. Has the computer made a difference in the "productivity" of individuals in your department? (Probe for differences in quantity, speed, quality, or other improvements in input, thruput, output.)

5. Has using a computer affected in any way the physical and psychological aspects of your job?

   a. Physical complaints? (eyes/headaches; back/neck/shoulders?)

   b. Social issues? (opportunities for interaction? adequate privacy?)

   c. Psychological responses (computer fear; attachment to former workstyle; job insecurity; stress)

6. Has using a computer affected your job in official terms, e.g., new job title? new job description? computer-related pay increase? other?

7. What has been the general impact of computer-mediated work on the quality of working life for you? On your job satisfaction? On your opportunities for advancement (here or elsewhere)? On your satisfaction with the management?

CLOSING REMARKS

1. Having been through this experience, what advice would you give to people who are just starting out?

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2. What can organizations or government agencies do to ensure that advanced information technology will have positive rather than negative impacts on white collar work?

TERMINATION

a. Thanks for cooperating. May we phone if we have questions as we're thinking over this discussion?

b. We expect to hold feedback sessions when we have put together a preliminary report, sometime in January. We'll call to arrange an appointment.

c. The Rand study will be incorporated with other materials by the Office of Technology Assessment as a report to Congress in June. After that Report has been filed, Rand will publish and send to participants its research results.

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APPENDIX B

Emerging Issues

In the text of this research report we provided evidence that the introduction of computer-mediated procedures in white collar settings need not degrade work nor deskill workers. In fact, focusing attention on these potential consequences may obscure other significant issues that are likely to emerge as organizations make successful transitions to electronic information tools. Given that these are work-transforming new technologies, their use is likely to pose challenging and perhaps unanticipated questions that will require creative resolution.

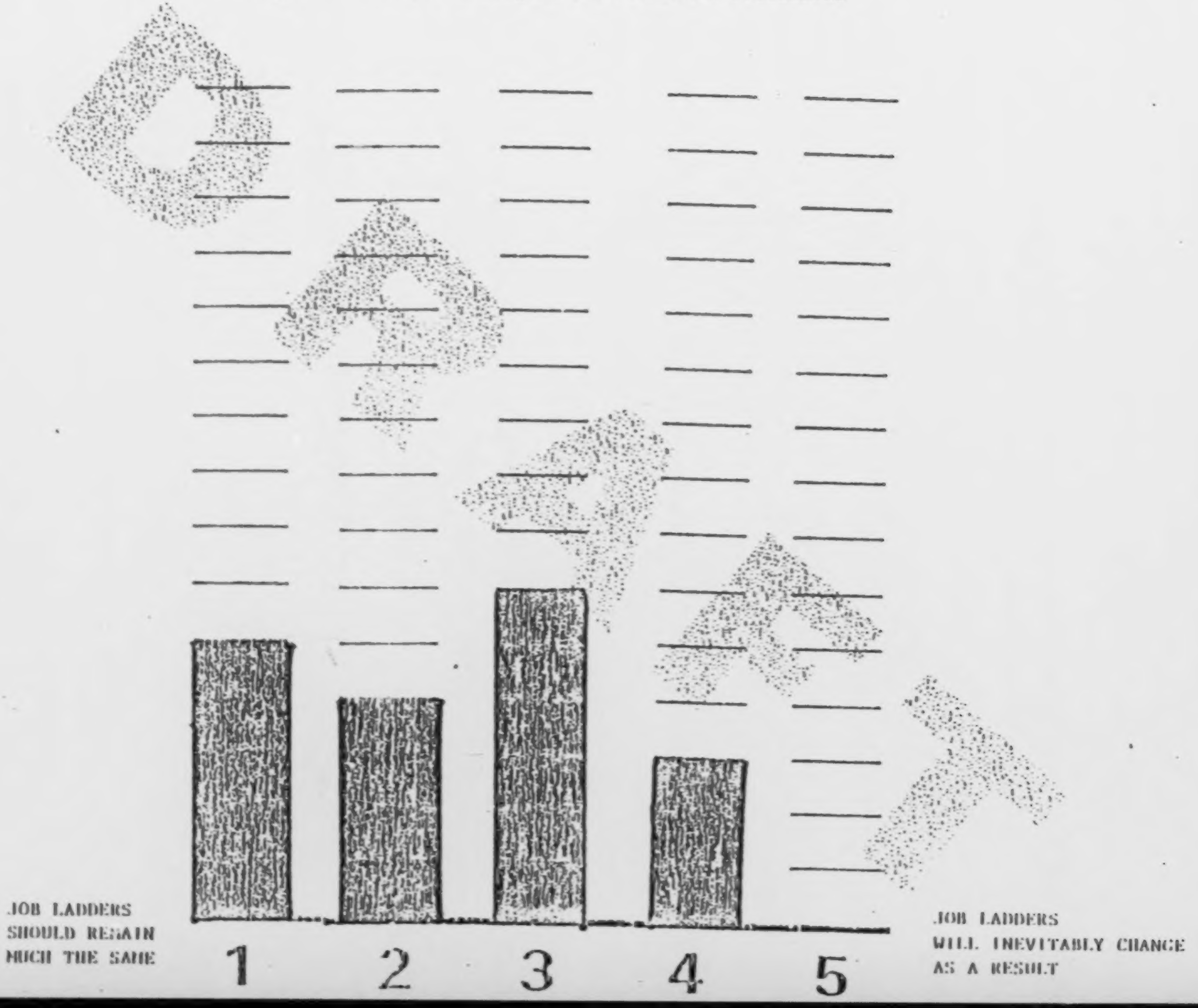
In the process of comparative work group examination the research team gave special attention to identifying and expressing such issues. Briefly, we sought them within topic areas where employees in at least two work groups appeared to have divergent experiences or beliefs; the divergence was at least potentially conflictual in some respect; the outcome was not known; and different resolutions could differentially impact the individuals and groups involved.

To elicit clarification and comment, we expressed each issue as a question or speculation with bipolar outcomes arrayed on a five-point scale. These issue scales were distributed to groups of research participants at the beginning of on-site feedback sessions for immediate completion. Their responses were tallied while one researcher presented an overview of the case study and its major findings. Histograms displayed on transparencies with an overhead projector served to focus subsequent discussion about each issue (see sample, Fig. 1.3).[1] Below we present each of the 13 issues along with a brief account of how it

---

[1] Three feedback sessions were conducted, one for executive management and two for other employees who participated in the study. In the executive session we did not collect completed response sheets; instead, the nine participants retained them and compared their own responses with those obtained in other sessions. Summary histograms in this Appendix present data collected from employees who signed up for non-executive feedback sessions (N=17). Where top management views on an issue appeared to differ from those of other participants, the divergence is described in the text that follows the histogram.

Fig. 1B -- Sample Histogram From Feedback Procedures



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arose, a summary histogram representing session participants' initial responses, and a summary of the comments this feedback elicited.

Instructions to Participants

> As organizations get beyond the first steps toward computer-based procedures in white collar work, a variety of issues emerge. Below we have sketched a few of the issues raised in the course of this case study, along with some stances commonly taken toward them. Please circle the number that most closely reflects your view on each issue.

Issues

1. A wide range of computer use--from NONUSER to TECHNOPHILE--can create alternative user environments.

At Company XYZ, as is the case with other organizations, a variety of user types emerges. *Non-users* want nothing to do with computers. These individuals may be afraid that they can't learn, have no interest in learning, or have legitimate reasons why their job does not require learning. *Reluctant Users* do so because it's part of their job. Given a choice, however, they might not use the technology. *Enthusiastic Users* have few technical skills to start, but they are excited about the computers, willing to learn, and possibly see computer skills as a way to job advancement. Finally, *technophiles*--who may also begin with few computer skills--embrace and experiment with the technology, and often become in-house experts.

The issue is whether this variety of user types can work in harmony in ways which promote, not impede, the work--or does variety necessarily create a have versus have-not atmosphere? How can organizations integrate these differences?

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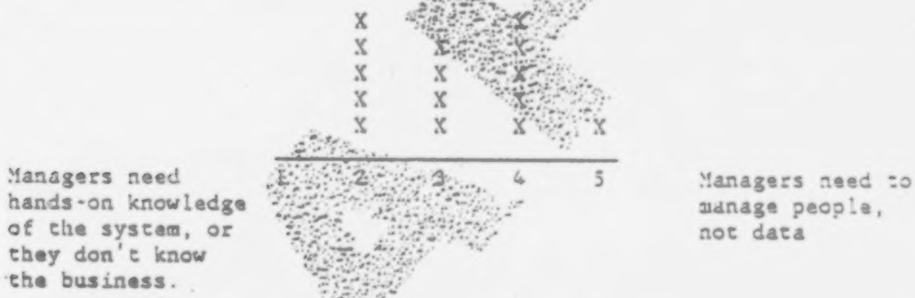
```
                                     X
                                     X
                         X     X     X
                         X     X     X
                         X     X     X     X
                         X     X     X     X     X
                        ___________________________
There will be room       1     2     3     4     5   Two distinct, possibly
for all types                                      antagonistic, groups
                                                   will emerge (users vs.
                                                   nonusers)
```

Associates acknowledged their worry, when the system was being introduced, about whether there would be an "A-Team and a B-Team" consisting of people with and without strong technical aptitudes, respectively. Their current view is that the critical skill is understanding how to bring information to bear on decisions. Whether needed data are obtained by directly interacting with the computer system or in some other way is relatively unimportant compared to knowing what information is needed and how to apply it. It was noted that high-skill users do tend to become "service departments" for nonusers who need computer-based information; however, it was also noted that nonusers can bring a fresh view to how information can be organized and treated.

Top management respondents underscored the relationship between tools and job performance. If computer technology is a factor in the performance of some jobs, then employees will have to be able to use it. Performance, then, was seen as what reconciles differences along the user continuum.

2. What should be managers' involvement?

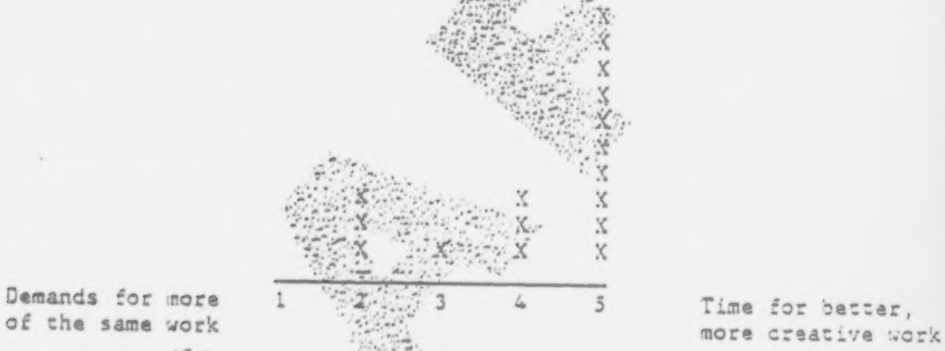
Whether and how information technology can change the traditional manager's role is an important issue. On the one hand, some users expressed concern that managers who lacked hands-on experience with systems did not really know what tasks they did. Some managers also felt disadvantaged by their lack of knowledge of the systems and applications used by their subordinates. On the other hand, users expressed concerns that a manager who spends too much time on-line may be neglecting his or her management duties.



The tool-using theme was emphasized in response to this issue. It was agreed that at Company XYZ managers are working units--it's expected that they have their hands on their work. The issue, then, is to what extent the working managers need to interact with the computer in order to know the business they are managing. It was emphasized that systems make no decisions, people do; and the job of managers is to understand the decisions made by people in their departments and the kinds of information the decisions were based on. Consequently managers may need to know the models, data structure, and logic of the information system relevant to the work of their departments. Whether they need to interact directly with the computer system for this purpose depends largely on the nature of the department's work.

3. Computers let users perform many of their tasks faster. This leads to:

As with many advances in work technology, computers make it possible for employees to perform their tasks in less time. The issue is what happens with the time that is saved? Are increased demands placed on users for more of the same work, or are they given the opportunity to be more innovative and to improve the quality of their work?



Participants unanimously agreed that computer-based procedures do save time, and that for the most part the time saved gets used for better work. The group was careful to point out that, with manual procedures, time itself placed serious limits on the quality and creativity of information work--there just wasn't time for more than fairly routine manipulation, analysis and reporting of information. Management respondents, however, acknowledged that when people are able to do more work faster it creates the potential for boring, repetitive or unrewarding work. Their view is that such consequences can and should be avoided by job redesign.

4. Users spend varying amounts of time--sometimes a great deal of it--in technical activities.

Introducing computers into office work significantly increases the amount of time users spend in essentially technical activities such as maintaining databases, training others in computer use, and devising new applications. Does this mean that the user is now more skilled or that the nature of the job has changed? If so, should these changes be reflected in job descriptions and levels (and, by implication, pay or promotion)? Or is it more appropriate to view the job as essentially unchanged, and computer users as performing the same functions as before but with different tools?

```
                              X
                              X
                              X
                              X
                              X
                              X
                              X
                              X
                              X
                    X         X         X
                    X         X         X
                    -----------------------------------------
Job descriptions    1         2         3         4         5    Existing job levels
and levels should                                                and descriptions
be revised to                                                    remain appropriate
reflect them                                                     nevertheless
```

The dominant view on this issue was that job descriptions and levels should change but only if job content changes--and using electronic tools may change job content because tasks and tools reciprocally influence one another. For example, there are jobs that can't be done without using the computer now (e.g., optimizing formulas over a set of criteria), and there are instances in which online work capabilities have changed the scope of employee responsibility (e.g., by providing the kind of information that enables a lower level manager to make an on-the-spot decision that formerly could have been made at a

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higher level). In these kinds of cases, job descriptions or levels probably need changing. However, it was emphasized that time spent using the technology--like time spent on the telephone--is no indicator of whether someone is doing it wisely or well

5. Users come to depend on special programs developed and shared by others. This practice:

With the emergence of in-house expertise and department-level "technophiles" comes the local development of special programs and procedures. The technophile may, for example, write a SAS program that does a particular analysis needed by several analysts in his or her department. This program is shared within the group. Because writing and sharing programs is not really part of the technophile's job, it is unlikely that time will be taken to document the program. Some departments rely heavily on their local experts. When asked what he would do if his expert left, one manager said he would go to the nearest bar! Although developing and sharing special programs and procedures is innovative, does it pay off in the long run? What good are undocumented programs if the expert is gone and problems are encountered? How can the organization protect its investment in user-generated applications?

```
                           X    X
                           X    X
                           X    X
                           X    X
                      X    X    X    X
                 X    X    X    X    X
                 ________________________
Creates dangerous 1    2    3    4    5     Is an innovative
reliance on                                 way to enhance
undocumented                                computer systems
procedures
```

Interestingly, top management seemed less concerned about this question than other respondents, who regarded the issue as more "thorny." Everyone agreed on the value of "home grown" software applications and special routines--and also that, because such programs are both relied on and undocumented, problems do arise when the innovator leaves the organization. Many respondents thought the situation was no different from what happens with manual procedures--where ways of structuring, manipulating, and storing information are also undocumented and where inheriting someone's file cabinet, for example, can be more of a burden than a benefit.

Some expressed the view that, when a "de facto" expert in some application domain leaves, others learn how to manipulate the system and readapt it to the task in new and possibly better ways. In contrast, it was feared that those who remain might simply inherit a set of applications they don't understand, can't modify, and can't respond to in a problem-solving mode when things go wrong. It was, finally, agreed that some locally-generated applications become vastly more important to the conduct of work than others--those should be identified and documented.

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6. Computer users frequently experience eyestrain or back/neck discomfort.

A number of people at Company XYZ voiced complaints of this nature during interviews, but few expressed a desire for external intervention. This anti-intervention view is shared by others, as evidenced by the recent failure of a bill in the California State Legislature which was to provide worker protection regulations for computer users. In the absence of government regulations, what steps, if any, should be taken to assure health and safety? Who should have responsibility for employee protection in this area?

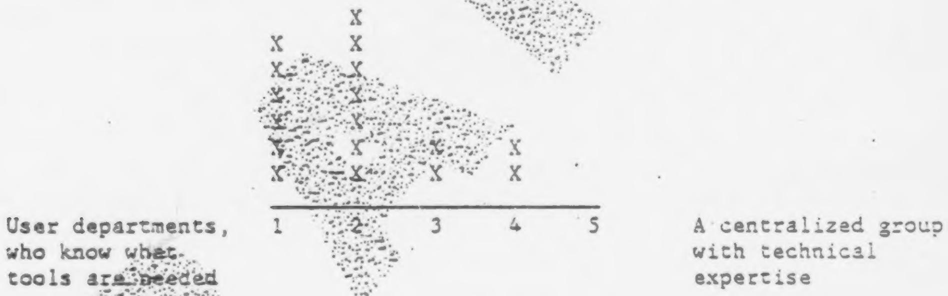
```
                                X
                                X           X
                        X       X     X     X
                        X       X     X     X     X
                        X       X     X     X     X
                        ---------------------------
Health & safety         1       2     3     4     5     Government
regulations should                                      regulations
be developed                                            in this area
                                                        are undesireable
```

Everyone agreed that there are physiological discomforts related to use of video display tubes. The issue seems to turn on who owns the problem and what should be done about it. Respondents do not believe it is government's problem and think of federal or state intervention in the form of standards or regulations as undesireable. They seem to believe that not enough is known about how to provide really good workstations in actual work environments, and that both vendor and user organizations are experimenting to find answers. De facto standards are expected to come from best practices as they emerge and are widely adopted.

Their view is that market forces will drive adoption of improved health/safety practices related to workstations in a number of ways. Vendors have a clear incentive to move ahead in this area, since whoever solves workstation problems first will have a strong competitive foothold among user companies who are concerned about their employees. Second, user companies who do not adopt improved practices will lose valuable employees to competitors who do. Bargaining units were not seen as having much potential leverage in this arena by employees, who thought white collar unionization was either highly improbable or at best a very long way off. On the other hand, the threat of civil litigation from white collar employees should provide a strong impetus to eliminate negative workstation health/safety practices. Finally, some employees thought that, as a last resort, the government's role might be to help protect white collar workers via corporate economic sanctions or incentives.

7. Computer system development should primarily be driven by:

Some people argue that a centralized group with computer expertise (e.g., an information services or data processing department) should play the dominant role in systems development. This enables the standardization and integration of systems across an organization. On the other hand, users may know best what they need; they may not use effectively, if at all, a system they did not play a major role in developing. Therefore, a counterargument is that user departments should be the driving force in systems development and implementation.

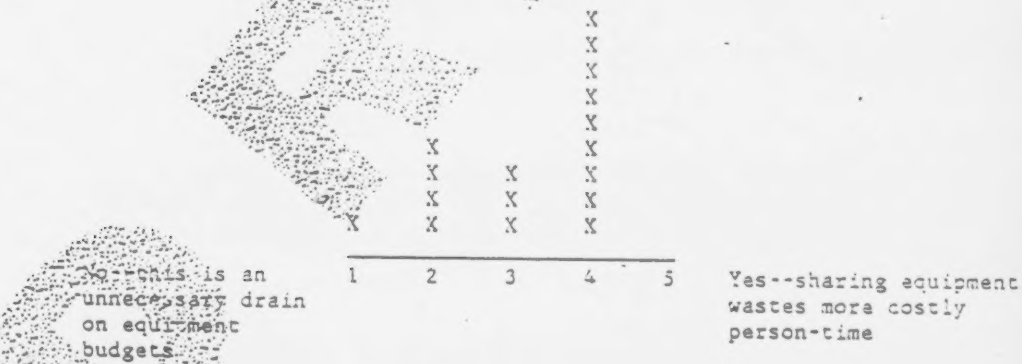


Participants emphasized users as the driving force in implementation, with the understanding that there is also necessarily an important role for centralized technical expertise. The issue, however, generated many comments and caveats. With respect to warnings, users pointed out that some parts of an information system should be centrally and uniformly maintained (e.g., customer billing should be but decision support should not be). Second, the importance of targeting an overarching system architecture as an organizational development goal was stressed. Third, users cited the need for effective dialogue between substantive users and technical experts.

From the perspective of user-driven development, respondents urged organizations not to underestimate the pay-offs of user commitment to the resulting system--not only do they use it, they are always trying to find ways to make it work better. Next, they argued that the need for formal computer expertise in development had been overestimated--current fourth generation languages and other capabilities permit the motivated and task-competent user to do a great deal. The message, in no uncertain terms, was "give users the benefit of the doubt for generating applications." Finally, top management encouraged organizations not to be afraid of chaos, emphasizing experimentation as the key. They acknowledged that this strategy has costs, but it allows the organization to get rid of mistakes and to learn. As a bi-product of top-down plus bottom-up development in this firm, the two initially opposed poles began to move closer together and to respect each other.

8. When computer use isn't an 8-hour-a-day activity, do you need as many workstations as users?

This is basically a cost versus access tradeoff issue. Although most users are not online all the time, users who have to wait for system availability are not productive and often become frustrated. When an organization is paying top dollar for its employees, shouldn't it provide them ample tools for doing their jobs?



With respect to workstations, most respondents believed that Company XYZ needs more but that a 1:1 ratio is not necessary. Task queuing is the way that information workers have to organize their activities--whether the queue starts outside the workstation or inside it. It was agreed that the nature of some jobs required workers to have more constant access to a VDT. One user, however, pointed out that access difficulties do not plague orderly task sequences that are going according to plan; more typically they represent a sudden unanticipated question, problem or bug for which immediate online "fire-fighting" is the only solution. The answer to the question "when do they need access" is always "now," and waiting means prolonging a crisis.

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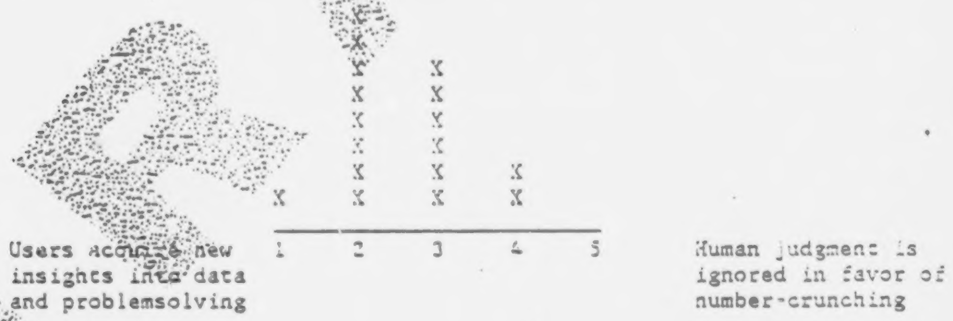
9. When a lot of work in an organization is done online:

Computer technology provides the opportunity to access more information faster and to examine it with more sophistication than before. Does this availability promote better question-asking, or just bigger data fishing expeditions? Are intuition and judgment still important in decision-making, or do people become slaves to the data?



Participants said that in firm XYZ number-crunching is not valued for its own sake--it makes sense only in the context of some purpose. Again they stressed the concept of the computer as tool, pointing out that numbers don't make decisions. On the other hand, the system is designed to make some of the easy, routine decisions so that humans can pay attention to the hard decisions. Some analysts described the value of number-crunching as "helping you better educate your educated guesses."

10. When a lot of work in an organization is done online:

If computers change users' jobs in significant ways--to the extent that job levels and descriptions are changed for example--will this affect career paths and job ladders? Are users likely to move into different kinds of jobs, having gained work-related computer experience?

```
                                  X
                                  X
                                  X
                                  X     X
                                  X     X
                                  X     X
                                  X     X
                            X     X     X     X
Job ladders           1     2     3     4     5       Job ladders will
should remain                                         inevitably change
much the same                                         as a result
```

While job descriptions may undergo substantial change as a reflection of the increasing importance of information technology in white collar tasks, job ladders probably should change less. Again, the theme was that performance is rewarded, not tool using per se. Further, employees noted that jobs on a career path are defined relative to one another--all are increasingly computer-based, and the whole path is moving apace. However, increasing experience with information tools may have opened new options; for example, individuals at the lower end of the job hierarchy are able to increase the scope and responsibility of their work (facilitating upward moves), and in some instances lateral mobility has been enhanced.

11. How is training best handled?

Training comes hand-in-hand with technology implementation. Whether training is handled formally, through sequenced instruction, or informally, from peers and do-it-yourself instruction, organizations must decide who should provide training and how much training is needed. If a great deal of the training is handled informally, on an ad-hoc arrangement and by peers, should peer trainers be rewarded? Should some proportion of their work time be formally allocated to peer training?

```
                                   X
                         X         X
                         X         X         X
                         X         X         X
                         X         X         X
               X         X         X         X         X
               _________________________________________
Users learn best   1     2         3         4         5     Users learn best
through formal,                                              from their peers,
sequenced                                                    on an as-needed
instruction                                                  basis
```

The complexity of training as an organization becomes increasingly sophisticated with information tools was highlighted in all feedback sessions. Respondents valued formal instruction as an introduction to widely-used applications, after which they believe it requires supplementation with peer training. Peer training is regarded as an inherent part of the way user departments operate in this firm. While there are no extrinsic incentives for de facto teachers, both self-reward and the applause of colleagues were highly valued by these self-selected experts. Besides its flexibility, proximity and task appropriateness, peer training was found to build cohesion and reciprocity in work groups. However it raises cost questions--how can departments afford to let valuable employees spend lots of time in 1:1 training, and how can these teachers find enough time to get their own work done? So the issue is viewed as really a two-part one: how to provide the best learning, and concurrently how to give teachers a break? At XYZ these trade-offs are informally worked out within departments, and ultimately costs force a balance between them.

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12. Should personnel departments have a key role in implementation?

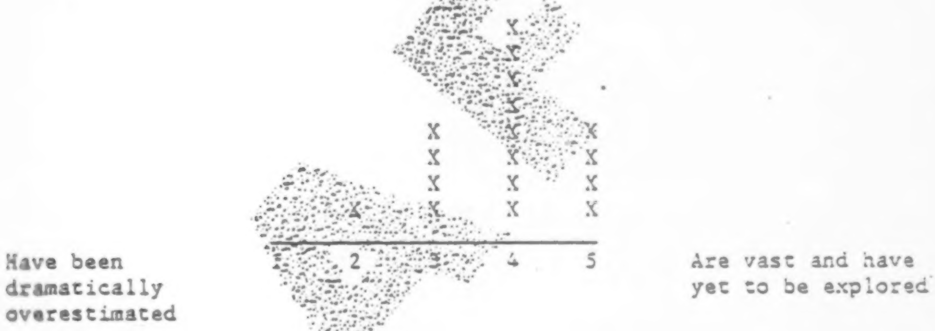
Introducing computers into white collar work clearly brings up a number of issues that have traditionally fallen under the purview of human resource or personnel departments. These issues include the development of training programs, possible impacts on job descriptions and levels as well as career paths, employee job satisfaction, and the like. Given the significance and pervasiveness of these issues, shouldn't personnel departments play a key role in the introduction of computer-mediated work?

```
                                X
                                X     X
                                X     X
                                X     X     X
                       X        X     X     X
                       X   X    X     X     X
                       _________________________
Yes, in training       1   2    3     4     5     No, technical or
and job (re)design,                               user departments can
for example                                       handle these things
```

Having heard participants' comments on issues involving training, job redesign and career path changes, it was no surprise to learn they think personnel departments--given the way they currently operate--should not have key roles in implementation. Respondents' believe that personnel departments typically operate as rule-keepers and protectors of the status quo; thus they should "Stay out," most said. However there was agreement within top management that there is probably a need to reconsider the role of personnel departments in relation to the kinds of changes in work that can accompany the implementation of organizational information systems.

13. Once you become an experienced user, it is clear that computer capabilities:

Until employees gain sufficient experience with computers and see for themselves what computers can do, they might not be able to fully imagine the range of potential applications and uses. On the other hand, organizational expectations about what can be done with computer systems have often proved unrealistic. Therefore, there is the possibility of unfulfilled expectations.



The overwhelming response from participants was that the capabilities of interactive organizational information systems are largely untapped. They point out that the potential for computer-based work has often been misestimated or misunderstood, and that they are just beginning to see what can really be done.

14. The way computers have entered work at Company XYZ:

Is there something unique about Company XYZ that would make it impossible or particularly difficult to replicate their experience elsewhere? Or could other firms borrow from the XYZ model?

```
                                       X
                                       X
                                       X
                                       X
                                       X
                          X            X        X
                          X      X     X        X
                          X      X     X        X
                     ________________________________
It probably          1    2      3     4        5       Most organizations
couldn't be                                             could probably do
done like this                                          do the same thing
anywhere else
```

This issue generated a great deal of discussion in all sessions. The general concensus was that most organizations COULD probably do the same kinds of things, but that in fact most WOULD NOT. Here are some of the properties of Company XYZ that participants emphasized as part of the success story. Several mentioned that the transition to computer-based procedures is easier in a young, medium-sized organization--where there is less red tape and less entrenched turf. Others argued it could not have been accomplished had it not been built on a policy of high skill/high pay. Most cited elements of the implementation strategy. For example, at Company XYZ the system came in as a response to a serious economic problem--its operation rely heavily on information work, manual procedures are slow and cumbersome, and new technology held the potential for turning the business around. Moreover, they had confidence in computer-based information systems and really believed in them as problem solving tools. Further, the technology transition was voluntary, not forced, for users. Finally, the willingness to experiment, to do things differently, was stressed: "You have to be able to change" was the bottom line.

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Office Automation in a Manufacturing Setting

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OFFICE AUTOMATION IN A MANUFACTURING SETTING

A CASE STUDY PREPARED FOR THE

OFFICE OF TECHNOLOGY ASSESSMENT

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TABLE OF CONTENTS

INTRODUCTION

The Office of the Factory.......................... 1
Methodology.. 3
The Primacy of Organizational Issues............... 4

THE AIRCRAFT INSTRUMENTS PLANT

Economic Context................................... 7
Organizational Structure........................... 8
Sociology..10

THE OLD SYSTEM

Production Planning and Control....................11
Negotiation..14
Management Criticisms..............................20

THE CONCEPT OF MRP

Computer System....................................23
Manufacturing Information System...................25
Management Philosophy..............................27

IMPLEMENTING MRP II AT THE AIRCRAFT INSTRUMENTS PLANT

The Core Team......................................33
Costs and Benefits.................................35
Structure Review...................................39
Training...40

IMPACTS OF MRP II

The "Wildness of Converting".......................47
The System vs. Production..........................50
Product Knowledge..................................58
Monitoring Worker Performance......................61
System Knowledge...................................65
Terminal Work......................................71
Who Does the Work?.................................77

CONCLUSION

INTRODUCTION

The Office of the Factory

The term "office automation" usually brings to mind images of mass data entry operations at an insurance company or bank, or perhaps the introduction of word processing at a law firm or corporate headquarters. However, the effects of computer-based technology on one of the most common "offices" in American industry today remains largely unexamined: office automation in those clerical workplaces that handle ordering, inventory, scheduling, co-ordination and control in the manufacturing facilities of private industry.

Every manufacturing firm has an office which performs a variety of functions crucial to the success of the industrial enterprise. According to one estimate, the people who work there make up ten percent of the clerical workforce in the United States today.[1] Clerks take orders for a variety of products and break the products down into their component parts. The components are then ordered from a vendor or built on site. As the components wend their way through the factory, expeditors and production control clerks track their progress and position them for final assembly. Finally, still other office workers make sure the parts meet the appropriate quality standards and ship them to customers.

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[1] Harvey Brooks, Kennedy School of Government, Harvard University. Personal Communication.

The complexity of these interrelated tasks in modern industry is daunting. A product cannot be built unless all the components arrive at the proper location at the proper time. This co-ordination process is becoming even more important as firms turn to potentially more efficient work organizations based upon minimizing inventory on the shop floor. For these reasons, the "Integrated Computer-Aided Manufacturing" Project (ICAM) of the U.S. Air Force has recently recommended that factory planning and scheduling functions become a principal candidate for computer automation.[2]

For the last fifteen years, companies have used a variety of data entry and computer print-out techniques to create an "after the fact" tracking system for their business. Today, the price of computer terminals has dropped low enough and the sophistication of software has become great enough to make possible "real time" scheduling and inventory systems. Usually known by the generic term of "MRP" (for "Materials Requirements Planning" or

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[2] "U.S. Air Force Integrated Computer Aided Manufacturing Program Prospectus--Update B," Air Force Materials Laboratory; Wright-Patterson Air Force Base; September 1979.

"Manufacturing Resources Planning"[3]), such systems integrate the various functions of the industrial office and automatically track components on the shop floor as they are being produced. They promise to provide managers and workers with immediate up-to-date information on the status of all orders, inventory, work in progress, billing, and shipping.

In this respect, MRP systems touch not only the clerical workers of the industrial office. Their impacts ripple through the entire production process, affecting every category of worker and each industrial department--marketing, purchasing, engineering, manufacturing, and the like. MRP systems constitute a new "central nervous system" of the factory, not merely tracking individual parts but co-ordinating the entire production process. Thus, they hold the key to improving industrial productivity and competitiveness.

Methodology

This report describes the introduction of an "MRP II" system at a medium-sized factory, known in these pages as the "Aircraft Instruments Plant." It examines the economic, organizational, and social impacts of the system on the factory and its workforce. The study is based on some 75 hours of interviews with approximately 30 employees at the plant, conducted in December 1984 and January 1985. The individuals interviewed include a broad cross-section of managers, systems designers, supervisors, clerks, shop floor workers, and union officials. However, the study focuses on the experiences of the clerical workers in the plant's "Production Support" department, in particular Production Planning and Control supervisors, clerks, and expeditors.

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[3] The distinction between these two terms will be explained in the section on "The Concept of MRP." According to one estimate, there are some 1000 MRP systems of one form or another currently in place in American industry.

We think of this study as an "ethnography" of office automation. We use a term borrowed from the discipline of anthropology to emphasize our belief that it is impossible to abstract the "impacts" of technology from the social relations and cultural milieu surrounding its design and use. Thus, these pages will take a highly detailed look, not only at the MRP technology itself, but also at the production planning and control work process, the general manufacturing process at the plant, the concept and philosphy of "MRP," the system implementation process, labor-management relations, and other dimensions of the plant's social life. Only by indicating the interrelationships between these various areas can we begin to specify what the impacts of the new system have been and why.

The Primacy of Organizational Issues

At the time we conducted our interviews, the MRP II system at the Aircraft Instruments Plant was in the process of being implemented, a situation that presented both a disadvantage and an advantage. Because the entire system is still not in place, its full impacts are not yet known (although participants in our study did speculate on what those impacts will be and, based on their estimates, we do the same). However, witnessing the implementation process as it took place also provided us with a glimpse of office automation at the Aircraft Instruments Plant as it unfolded. And this made possible important insights into the process of implementation itself.

This is where the particular case of the Aircraft Instruments Plant has a more general interest. In recent years, there has been a growing literature highlighting the crucial importance of the social and organizational dimensions of workplace technological change.[4] Many observers have argued that the ultimate success of new workplace technology can depend, not only on the technical qualities of the hardware and software, but on the management of the technological change process itself. When social and organizational issues about the management of technological change are ignored, they can become a serious obstacle to the efficient design, smooth implementation, and effective use of new workplace technology.

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[4] See, for example, Richard Walton and Wendy Vittori, "New Information Technology: Organizational Problem or Opportunity?" Office: Technology and People, 1 (1983) pp. 249-273.

This has been an especially prominent theme in the literature on MRP, in particular.[5] In a study conducted by John Anderson and Roger Schroeder of some 679 midwestern companies of which 433 had MRP systems in various stages of implementation, the authors found that less than 10 percent of the companies surveyed were getting the full benefits of MRP, another 30 percent were getting good benefits but not full results, and more than half were getting modest benefits or no benefits at all. "...What appears primarily to distinguish success from failure," Anderson and Schroeder reported, "is the nature of management commitment in the company and the implementation process used....The firms that have failed have not been able to cope with the organizational change, behavioral issues, and people issues involved in successful MRP implementation. As a result, these companies have incurred the costs without getting the benefits."[6]

The story of "MRP II" at the Aircraft Instruments Plant illustrates some of the dangers that ignoring the organizational dimension of technological change can produce. It reflects how the demands of a new technological system can conflict with traditional management practices and style; how worker involvement in and commitment to the new technology at the shop-floor level is crucial to the technology's ultimate success; and how new technical systems, far from making traditional work skills obsolete, can make certain skills and expertise more important than ever before.

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[5] See, *inter alia*, John Anderson and Roger Schroeder, "Getting Results from Your MRP System," Business Horizons, May-June 1984, 57-64; David Roman, "Ollie Wight on Productivity in Manufacturing," Computer Decisions, April 1982, 171-174; and Oliver Wight, MRP II: Unlocking America's Productivity Potential (Williston, Vermont: 1981).

[6] Anderson and Schroeder, *op. cit.*, p. 58.

THE AIRCRAFT INSTRUMENTS PLANT

Economic Context

The Aircraft Instruments Plant is part of the "Aerospace Business Group" of a major American corporation. Out of a total workforce of approximately 1300, some 500 are managerial and professional personnel. The rest are production and clerical workers represented by a local union belonging to a large AFL-CIO international.

The plant manufactures a wide variety of high technology products such as aircraft instruments (including gyroscopes), engine sensors, displays and monitoring systems. Some of these products are highly complex; together they incorporate some 55,000 different parts. Much of the work at the plant is under contract to and manufactured according to the criteria of the Department of Defense. To fulfill the DOD's military specifications requires high quality, strict cost control, and extensive documentation and record-keeping.[7]

Until recently, the plant's corporate parent had considered Aircraft Instruments a mature business and, instead of targeting funds for investment and modernization, used plant profits to fund other corporate projects. However, in late 1981, the corporation formulated a new corporate strategy in which resources were set aside for Aircraft Instruments in the hopes of generating a much higher "return on investment." Since then, considerable new funds have been invested in the plant. The new MRP II system is a part of this new wave of investment.

Organizational Structure

The plant has five basic "product lines": 1) "Flight Reference Systems" (primarily gyroscopes); 2) "Thermocouple" (heat sensors); 3) "Current Products" (electromechanical sensing and display devices); 4) "Meds" (more recent electronic sensing and display devices); and 5) "Flow-Meter" (instruments that measure the flow of fuel in an aircraft engine). Because it was the first product to go "on-line" with the MRP II system, this study focusses on the major product of the "Flight" line, a gyroscope known as "KD-9."

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[7]At the time we were conducting our study at the plant, the Defense Department's "Defense Contractors Auditing Service" (DCAS) was performing an audit of Aircraft Instrument Plant practices, because some of the plant's products were not meeting contract specifications.

In addition to the five product lines, the plant also has four "contributing areas": 1) "machine shop," 2) "coil shop," 3) "printed circuit boards," and 4) "silk screen." These areas supply those parts and components to the five production areas which do not come from outside vendors. Two contributing areas in particular serve the KD-9 production line--the machine and coil shops. Thus, they have also been affected by the MRP II system.

In addition to these product lines and contributing areas, the Aircraft Instrument Plant is divided into seven functional areas--finance, marketing, purchasing, engineering, manufacturing, information systems, and employee relations. The "Production Support" functions that are the target of this study come under Manufacturing. Approximately 80 people perform production support functions throughout the factory. They are assigned to specific product lines or contributing areas.

For example, a specific Production Support office handles components for the "Flight" product line, including the KD-9 gyroscope. This office performs two functions--production planning and production control--and consists of a Production Support manager, two supervisors (one for Production Planning, one for Production Control) and five clerks and expeditors (who are "graded salary" personnel; they receive a yearly salary instead of an hourly wage, but they are members of the union's bargaining unit).[8] There is also a Production Support office for the contributing areas with its own managers, supervisors, schedulers, expeditors, and clerks. Their responsibilities are divided among the four contributing areas. Finally, there are people in the KD-9 shop itself who "interface" with these Production Support personnel--primarily, the shop supervisor, "dispatchers," and "gyro analysts." Organizationally, they are part of "Shop Operations," but they are also greatly affected by the new MRP system.

These three groups--Production Support for Flight; Production Support for the machine shop and coil shops (which contribute components to the KD-9 production line); and the supervisor, dispatchers, and gyro analysts of the KD-9 shop--make up the core workforce of our study.

Sociology

There is one final aspect of the Aircraft Instruments Plant of importance to this study on the impacts of technological change. Many of the senior salaried workers at the Aircraft Instruments Plant were hired in the years immediately following the Second World War.[9] Because of union seniority rules, these workers are now concentrated in the highest job classifications of the plant, including the graded salary positions of the Production Support office. In recent years, these high seniority workers have begun to retire in large numbers, and this poses a problem for plant management. Because of the long tenure of many workers at the plant, there has traditionally been little incentive to invest in the explicit documentation of work procedures and practices. Instead, highly skilled and knowledgeable plant veterans tended to carry these procedures around in their heads. But, as this earlier generation of workers retires, the plant runs the risk of losing forever important job skills held by older workers which have not been passed on to the new generation of younger workers moving into the plant. Thus, management feels it must systematize and formalize work practices in order to counter the loss of important informal expertise. This is a major motivation for the MRP II automated inventory control system.[10] In the words of the manager of the MRP II project, "we are moving from making products by art to making them by science."

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[8] Most of the union workers interviewed for this study were G-9s, G-10s, and G-11s. As of January 1, 1985, the weekly salaries for these categories were $423.69, $447.35, and $485.30 respectively.

[9] For example, of the 39 G-11s at the Aircraft Instrument Plant, 25 were hired between 1939 and 1950. Fourteen were hired between 1951 and 1968.

THE OLD SYSTEM

Production Planning and Control

For about the last fifteen years, the Aircraft Instruments Plant has used a computer system for production planning and control known as IMS. Standing for "Inventory Management System," IMS is run out of a centralized corporate computer center in Utica, New York. Originally purchased from an outside vendor, the system has been highly customized over the years by corporation system designers in order to fit the requirements of the Aircraft Instruments Plant.

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[10] It is striking how those managers and systems designers who are implementing MRP at the Aircraft Instruments Plant are predominantly young with little tenure in the plant, while the workers who are bearing the impacts of the system are, for the most part, plant veterans.

Each time a customer places an order with the plant's marketing department, a paper record goes to the "Order Entry" department where key-punchers put it into the IMS system. Once a month, the system does a batch-processing operation known as "reinitializing" which breaks the orders down into their component parts. The product of this operation is a monthly "profile report." It is like a photograph of all the material in the plant at a particular moment in time. It up-dates all material on-hand, on-order, and in "picks" on the shop floor (a pick is an accumulation of material grouped together to build a specific product for a particular customer). It also identifies "shortages"--parts required for current orders but not yet present in inventory.

The profile report tells Production Planning clerks what parts need to be ordered. They put out "order action reports" which set into motion the ordering process. Those for "outside vendor" or OV parts go to purchasing. Those for in-house "make" parts go to one of the contributing areas. In general, it takes Production Planning the entire month to go through the profile report, generate new orders, and schedule them on the factory floor. Then, when the new monthly profile report is produced by the computer system with its up-dated record of plant inventory, they begin this process all over again.

In addition to these order action reports, IMS also produces a number of other documents. For example, "pick requests" go to the stockroom. They call for certain parts to be "mortgaged" or set aside for the manufacture of particular products. "Shortage sheets" go to Production Control. They list all those parts required to fulfill current customer orders which are not yet on hand or on order.

The supervisors and expeditors in Production Control follow these orders on the shortage sheets into, through, and out of the plant. Because they are responsible for parts from the moment they arrive at the plant to the moment they are shipped out in products, one Production Support manager describes their job as shepherding parts "from womb to tomb."

Some expeditors handle "OV" parts; they work with "procurement clerks" in purchasing (who deal directly with the outside vendor) and follow the order through receiving and quality control to the product lines. Others handle internal "make" parts; they deal with their counterparts in the Production Support office in the contributing areas. Once parts have arrived at the designated product lines, expeditors serve as a kind of mediator between marketing and the shop floor. When marketers want to know the status of a particular customer order, they go to Production Control; the expeditor then goes to the shop supervisor for the appropriate information.

Other Product Support personnel schedule and co-ordinate the work of the contributing areas. G-11 production control clerks "promise" parts to the various product lines (i.e., they set estimated dates for when the parts will be completed). Each promise is based upon a combination of factors--material already available in the area, promises the scheduler himself has received from purchasing or other contributing areas, the estimated production capacity and "cycle time" required to manufacture the parts, etc. Then, with shortage sheets generated by IMS, G-9 expeditors move the parts into the contributing areas and out to the product lines.

Negotiation

Of course, the above is only a _formal_ description of the production planning and control process under IMS. In fact, the actual workings of the system are considerably more complicated. Things often don't happen as smoothly as the formal description suggests. The process is rife with irregularities and conflicting priorities. Far from being a clear-cut, step-by-step process, production planning and control is really a never-ending series of complex informal negotiations.

The technical limitations of the IMS system itself constitute one important source of irregularity. Because the profile report is only generated once a month, it quickly becomes out-of-date. More serious, over the years, inaccuracies have accumulated in IMS that, once in the system, are extremely difficult to identify and eliminate. IMS, says one veteran expeditor, is "inaccurate as hell. Anytime you make a mistake, it just multiplies itself over and over again. In one case, they found they were buying parts they hadn't been using for fifteen years."

As a result, Production Support personnel often don't know whether the data they receive on the profile report is entirely accurate. Upon receiving the report, Production Planning clerks have to analyze the data and compare it against the more recent data available on their terminal screen or against the actual situation on the shop floor. One month, the profile report may indicate a large inventory for a particular part; the next, less than enough to match current orders. Why the sudden shortfall? The clerk must find out.

In another hypothetical case, a very expensive part that is normally used only once a year suddenly disappears from the profile report. Does the clerk reorder and, if in fact the parts have not been used, risk having money tied up in inventory for an entire year? "An awful lot of analysis work is required by the individual," says one Production

Support manager. "They have to do the analyzing work in order to find out what really happened."

But the irregularities of the production planning and control work process are not merely the result of the IMS computer system. Indeed, they are built in to the very organization of work at the Aircraft Instruments Plant itself. It is useful to think of the plant not so much as one integrated work organization but as a multiplicity of smaller competing organizations--the various functional areas--each with its own managerial hierarchies, each with its own priorities and goals. In order for these various units to work together requires considerable informal negotiation.

Take the example of marketing, the plant's first contact with the customer. Although marketers are supposed to make a "promise date" for delivery of a particular customer order in conjunction with the Production Support office, sometimes (perhaps under pressure from the customer or in order to do him a favor that will pay off at some later date) they go ahead and give dates on their own--even when these commitments are impossible to fulfill, given normal lead times for the product involved and current plant capacity.

This sets in motion a long negotiation process. When the Production Planning clerk discovers the scheduling conflict, she tells her supervisor. The Production Planning supervisor then discusses the problem with a supervisor in marketing. Usually, they can work out a mutually agreeable compromise. If not, then _their_ supervisors are brought into the negotiation, until the problem is resolved.

Another example concerns purchasing. When Production Planning orders an OV part, it sends a "travel order card" to the appropriate buyer in the purchasing department. The buyer then contacts the vendor who supplies the particular part. But what if the vendor cannot provide it in the time required by the schedule? The buyer is supposed to negotiate the best possible time with the vendor, but often he will take whatever date the vendor supplies. When the discrepancy is more than 30 days, the Production Planning supervisor then has to negotiate with the buyer and try to convince him to go back to the vendor for a more acceptable date. "Some cases, they can do something about," says a Production Support manager, stoically. "Some, they can't."

Negotiation is also a daily part of the Production Control expeditor's job. Perhaps an OV part comes in that doesn't exactly correspond to its specfications but can still be used in the final product. While the part is held up in quality control, he must call in a manufacturing engineer who has the authority to o.k. a "materials deviation request." Without quick action on the part of manufacturing engineering, the part can linger in quality control for months.

In the contributing areas, Production Support personnel are constantly engaged in informal discussions, promises, and agreements. In each area, there are different schedulers and expeditors responsible for the components slated for one particular product line. Schedulers spend nearly half their time in meetings, competing with their colleagues over shop capacity and priority (one likens the process to "butting heads").

Thus, a major part of the production planning and control process involves the extremely social acts of persuasion, negotiation, and, at times, argument. As one Production Control expeditor puts it, "I'm just one leaf on the tree. I try to go in any and all directions in order to get a part out. It all depends on developing working relationships with people in other departments--purchasing, quality control, manufacturing engineering. It's a matter of trust built up over time. Personalities do play a big role in it."

Sometimes, effectively performing his job might mean doing favors for individuals in other departments, in the hope that, when the appropriate moment comes, they'll do a favor for him in return. In other cases, it may mean putting pressure on someone in order to get him to respond to the expeditor's concerns (but not so much pressure that the individual will become alienated or resentful). "Sometimes, you have to be down there pounding on his back," says the expeditor. "Because until somebody is hounding his foot-steps, he doesn't care."

This kind of informal negotiation serves to smooth the production process. It irons out conflicts between the various functional areas. However, there is always the danger that negotiation will break down and, in its absence, workers and managers alike will revert to the narrow priorities and demands of their own functional areas. Put another way, people will just follow orders rather than take responsibility for production.

A Production Support manager gives a recent example of just such a case: The Aircraft Instruments Plant was having trouble with production back-logs in the "Flow-Meter" product line; part of the problem was that "Flow-Meter" products were delayed while waiting for component parts from the machine and coil shops. The plant's General Manager told the Manager of Materials to solve the problem. The manager went to the supervisors of the machine and coil shops and, in the words of the Production Support manager telling the story, "he said, 'I want the parts for Flow-Meter and I don't care what it takes to get them.'"

The Manager of Materials is the supervisors' boss; of course, they had to abide by his request. So, they made the parts needed for Flow-Meter their top priority, at the neglect of components for the other product lines. This in itself is understandable. After all, Flow-Meter did need those parts, and top management had ordered it. But the supervisor also neglected to tell the manager of Production Support. He didn't discover what was going on until parts he had counted on did not show up. "You only find out when they blow your promise date," says the manager. "They don't want the hassle. They know that, if push comes to shove, they won't get any relief from making both your parts and somebody else's."

Management Criticisms

In August 1982, the Information Systems department at the Aircraft Instruments Plant developed a "Strategic Plan for Information Management." The key priority identified in the report was "asset management"--i.e., the various functions coming under the general term "production support": inventory, scheduling, production planning and control.

From the perspective of Information Systems management, IMS is totally inadequate. First, the technology is obsolete. Batch-processing at a centralized computer center is cumbersome and expensive. The fact that reports come out only once a month means that the system is always behind reality--thus the need for constant checking. And, with batch-processing at an off-site computer center, the Aircraft Instruments Plant doesn't control its own data-processing costs. Every time the center runs an operation for the plant, it has to pay, what the director of the Core Team calls "paying by the drink."

What's more, the original implementation of IMS was poorly managed with the result that the workers who had to use the system were neither familiar with its operation nor committed to its success. "They bought a system and never told anybody about it!" remembers a veteran expeditor who was present at the time of the IMS implementation. "The systems people would show up with these computer print-outs and nobody, management included, really understood how to use the information available in them." "It was a failure from the moment it started," says another. "It was just dropped on people and they floundered."

Also, over the years, the "integrity" of the data in the system was compromised. This is not only a problem of inaccuracy. IMS is basically an inventory management system. It does not include data from finance or purchasing; it is not linked with the manufacturing control reporting system on the shop floor. This means that the plant has a number of parallel record-keeping systems which cannot communicate with each other and which often conflict.

Finally, many of the customizations of IMS reflect what the director of the Core Team calls "non-standard materials handling practice." For example, one practice, known as "monthly inventory replenishment," was to automatically restock the shop floor every month. The system would make an estimate, based on past practice, about what material each product line would need. But often this estimate did not correspond to the reality of what customers were ordering or what the product lines were actually producing. And the fact that IMS is so heavily customized means that it is extremely difficult to change, leaving management with the choice of either limping along with the current system or scrapping it altogether.

In the words of the MRP project manager, IMS is "unintegrated, inaccurate, and redundant. It has no data integrity at all." But the problem with IMS is not merely a matter of technology. It is also a result of the inadequate "work disciplines" of the entire production planning and control system. According to the MRP II manager, "Production Planning" at the Aircraft Instruments Plant is not _really_ planning at all; it is merely "ordering." And "Production Control," instead of being based on realistic criteria and explicit priorities, is reduced to a haphazard informal process in which, says the director of the management Core Team, "parts get expedited primarily on the basis of who has the strongest personality."

Thus, the ultimate goal of the new MRP II system is not merely to up-date production planning and control computer technology. It is to redefine and reorganize the production planning and control work process itself. Specifically, its purpose is to eliminate the need for the tangled web of personal persuasion and negotiation structuring the planning and control process under the old IMS system; to co-ordinate production, not according to informal practices founded on personal relationships, but according to the explicit and impersonal imperatives of a formal system.

THE CONCEPT OF MRP

The concept of MRP has been around since the early 1960s. But, through the years, its meaning has gone through a number of permutations. Anderson and Schroeder have suggested three ways to think about MRP: first, as a computer system; second, as a "manufacturing information system;" and, third, as "a concept and philosophy of management."[11]

Computer System

There are two basic approaches to ordering parts in any manufacturing operation. The traditional method is known as the "order point" system. By estimating the average usage of a part during a particular time period, a company establishes an "order point" or specific level of inventory below which the supply of the component is not allowed to fall. As soon as inventory for the part drops below the order point, a new order is initiated. (One can think of the practice of "monthly inventory replenishment," used in the IMS system and described on p. 21, as a version of this order point method.)

"Material requirements planning," on the other hand, typically determines ordering, not in terms of some estimate of average usage, but based on schedules for the specific items used in the products to be manufactured. The fundamental idea of MRP is that of "product structure." Any product can be pictured as consisting of "components" and "levels" of assembly. At each level, components are put together to form a sub-assembly or "parent." And that parent itself becomes a component at the next higher level of assembly, combining with still other components to form a new parent. In this way, one can follow all the components of a particular product up a pyramid of levels until reaching the final assembly.

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[11] Anderson and Schroeder, loc. cit.

The "structure" of specific products can be extremely complex. For example, the KD-9 gyroscope contains over a thousand components put together in fourteen different levels of assembly. However, with an accurate map of product structure and precise information about how long it takes to either manufacture or purchase each component (commonly known as the "lead time"), one can then work back from the "due date" of the particular customer order to find out what components to order, how many, and when. This procedure of determining inventory quantities and order dates based on the structure of products to be manufactured is known as the "explosion."

Material requirements planning is potentially far more accurate than the order point system, but in the absence of the data-processing capabilities of the computer, it is extremely difficult to perform. In the early days of MRP, before computers were a common feature in the workplace, companies used to take six to thirteen weeks to calculate material requirements manually or with the help of mechanical tabulating equipment. Known as the "quarterly ordering system," it was not much more accurate than order point.

The advent of the computer made it possible to calculate requirements over the week-end, and companies began to order raw materials and parts in monthly increments, like the IMS system at the Aircraft Instruments Plant. (In this respect, IMS is a kind of hybrid between order point and primitive MRP systems.)

With more recent advances in computer hardware and software, however, companies have not only been able to do their materials requirements planning more rapidly and more frequently (for example, the new system being implemented at the Aircraft Instruments Plant runs the explosion twice each week rather than once a month). They have also been able to extend MRP beyond mere ordering to a whole variety of other production support functions. In other words, the technology of the computer makes possible a far more detailed and systematized approach to production planning and control than ever before--the creation of an integrated "manufacturing information system."

Manufacturing Information System

Anderson and Schroeder identify three distinct stages of MRP as a manufacturing information system. The first is simple "material requirements planning" or MRP I, which is primarily a system for inventory control. The computer executes the explosion, breaking customer orders down into their component parts (known as the "bill of materials"). The system then matches these "material requirements" against current inventory and orders, and generates new orders for the remaining parts needed. Because MRP I establishes priorities for ordering, it is often known as a "priority planning system."

A second, more comprehensive stage of MRP is both an inventory ordering and factory scheduling system. In addition to the functions described above, it includes a "master production schedule," "capacity requirements planning," and "shop floor control." The master production schedule matches customer orders to plant capacity in order to create a realistic production schedule (expressed in due dates) for the factory as a whole. Capacity requirements planning takes these due dates and schedules customer orders in the shop based on pre-programmed information about "lead time," the precise series of steps in the production process (known as the "routing"), and the overall capacity of the factory (divided into individual "work centers").

The system then automatically "releases" the components for each level of assembly to the factory floor on the level's "start date" (assuming that all the components necessary to complete the level are present in the stockroom). Finally, a shop floor control system provides feed-back on work-in-progress as the components move through the production process. This data is periodically fed back into the "master production schedule" and used to reschedule both inventory ordering and production priorities, according to the ever-changing situation on the factory floor. Because of this feed-back mechanism, this stage is often termed "closed loop" MRP.

But the third stage of MRP is even more comprehensive than this closed-loop system. At this level, the factory information system is extended throughout the entire work organization. Purchasing systems automatically generate orders for outside vendor parts. Marketing systems feed in statistical data to forecast future inventory demands. And cost data from the finance department is programmed into the system to make inventory ordering and factory scheduling "cost sensitive." At this point, MRP becomes something more than just a material requirements system. It becomes the primary information system for the entire work organization. For this reason, this third stage is known as "manufacturing resources planning" or MRP II.

"Theoretically, it should work just like the auto companies," says one manager involved in the Aircraft Instruments Plant MRP project. "The raw steel comes in here and out the other end comes the car."

Management Philosophy

The comments of this Aircraft Instruments Plant manager suggest an image of production planning and control as an almost entirely automatic process. However, it would be a mistake to assume that workers have no role to play in it.

While MRP II does automate certain tasks previously performed by workers, at the same time, it presents the workforce with considerable new demands. How they meet these demands is crucial to the ultimate success of the new system. For this reason, Anderson and Schroeder write that "...MRP must go beyond computers and systems for effective implementation."[12] Perhaps the most important definition of MRP is as a concept or philosophy of management.

Think back to the informal system of production planning and control at the Aircraft Instruments Plant. It is based upon negotiation and expediting in order to eliminate shortages and complete a product currently being manufactured. But the purpose of MRP II is to eliminate that informal system, replacing the social interchange of negotiation with the explicit and highly detailed requirements of a computerized factory scheduling system. Anderson and Schroeder call it "formalizing and systematizing a new way of managerial planning and control."[13]

However, this requires a qualitatively new kind of work discipline. People have to be trained to work according to the dictates of a formal system in a way they have never had to do before. The informal practice of negotiation is replaced by the formal rules of the computer system. It is a work process where, in the words of one plant systems designer, "everybody is singing the same song."

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[12] _Ibid_.

[13] _Ibid_., p. 59.

One aspect of this new work discipline is new responsibilities. For example, since the formal MRP II system controls the entire work process, it is absolutely essential that the data fed into that system be accurate. Instead of the data entry key-punchers of the IMS system, data is entered at terminals "on-line" by workers throughout the work organization, including Production Planning clerks, shop floor dispatchers, stockroom personnel, etc. And they must all take responsibility for the data they enter into the system.

The same time as workers are called upon to shoulder new responsibilities, they also have to cope with a work process that is becoming more and more abstract.[14] Under IMS, the basic unit of production is the customer order. Workers on the shop floor, the clerks and expeditors of the Production Support office, the pesonnel in marketing and purchasing all work to complete specific customer orders for plant products. Under MRP, however, the basic unit of production is not the entire product but each discrete level of assembly. Each time a particular level is completed, it must be returned to the stock room and its new status entered into the computer. Then, it becomes a component for another level of assembly (with an entirely different part number) in the next step of the production process. "The focus is no longer on the whole product," explains the manager of the MRP II project. "It's on the steps in the assembly of the product. And it's difficult to go from the whole picture to just one part of it."

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[14] For this concept of abstract work, see Shoshanna Zuboff, "New Worlds of Computer-mediated Work," Harvard Business Review, September-October 1982, pp. 142-152 and Paul Adler, "Rethinking the Skill Requirements of New Technologies," Working Paper HBS 84-27, Harvard Business School, Harvard University, 1983.

But the importance of working to the system, taking responisibility for data, coping with an increasingly abstract work process does not mean that workers don't have to exercise judgment under MRP II. In fact, there is evidence that work with highly integrated computer systems may make worker judgment more important than before. Just as MRP II links the various departments of the work organization together in a network of computer systems, it also links workers together in a new kind of interdependence. The scope of each individual's job is broadened and effective performance of that job becomes linked with the performance of others throughout the plant.

Put another way, while workers may have to know how to "follow the rules," that is not all they have to know. Indeed, if they think of their job as merely following rules, this could become a major obstacle to the effectiveness of the MRP system. "Our biggest area of concern is dispelling the 'it's not my job man' mentality," says a manager involved with the MRP project. "Throughout any computerized system, the judgment factor becomes increasingly important. We've got to instill a new set of values about how people go about their work."

This may be especially true for the personnel of the Production Support office. As the primary employees who work with MRP, their span of authority is increased by the spread of the system throughout the plant. For example, under IMS, as soon as an order was entered into the system, a shop supervisor had the authority to release the parts for it onto the factory floor. Under MRP, parts are released automatically by the system. And the only personnel who have the authority to manually over-ride the system are the supervisors of Production Planning and Control. Thus, if any personnel throughout the factory want to change the imperatives of the MRP system, they must do so through Production Planning and Control.

But the new centrality of Production Support imposes new demands on the employees of that department. In order to perform their jobs effectively, they must have some sense of the logic of the system; they have to be taught, not only what the system is prompting them to do, but why. They need to be provided with an understanding, not only of their own particular job, but of the entire system and work organization based upon it. And, as we shall see in a forthcoming section, they must recognize those situations when it is preferable not to follow the rules of the system. For all these reasons, the idea of MRP as a "management philosophy" (one might even think of it as an "ethic" of work performance) becomes especially important.

"The challenge of MRP," Oliver Wight, a prominent management consultant who is widely considered the "inventor" of MRP, has written, "is in teaching people in the business to operate with a formal system rather than the informal systems they have used all their lives....If any one sentence could best convey why most companies don't achieve the full potential of MRP, it would be this: They attack MRP as a computer system, rather than as a people system....Yet, without people who understand, everything else that is done to implement MRP will be a waste of time....It's critical that during the implementation, the focus be kept on the highest priority--the people."[15]

IMPLEMENTING MRP II AT THE AIRCRAFT INSTRUMENTS PLANT

When the managers of the MRP II project at the Aircraft Instruments Plant talk about MRP, they use language identical to that of Oliver Wight or Anderson and Schroeder. They talk about MRP as a "people system" and the importance of "sensitivity to the user." They continually emphasize that managing the organizational issues surrounding technological change is the key to the ultimate success of their efforts. "One reason the old system never worked is that people never really felt a part of it," says one. "This time, we've recognized that people play _at least_ as important a part as the computer--if not more so. We're emphasizing people as being the most important part."

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[15] Wight, _op_. _cit_., pp. 365-366, _passim_.

However, the evidence so far tells a different story. While project managers may actually believe that MRP is, at bottom, a "people system," they seem not to have thought through precisely how to address these all-important organizational issues. Their tendency has been to concentrate on the narrow technical details of "getting the system in," on the assumption that the details of how it is used can be handled later. And, in some cases, when they have tried to prepare for these organizational concerns (for example, the case of training on p. 40), they have been over-ruled by top management at the plant.

The result has been a situation where organizational issues have been either ignored or mishandled at nearly every step of the MRP technological change process. And while the MRP system has brought (in the words of the project manager) "new tools" to the Aircraft Instruments Plant, workers are still ensconced in "old roles." "If you were going to give me a report card," the manager of the MRP II project continues, "I'd probably get the lowest marks for the 'people' issues."

The Core Team

In May 1983, the general manager at the Aircraft Instruments Plant approved the plan to develop an MRP II system. The Information Systems department created a "Core Team" to select a vendor for the system and to oversee its implementation. The head of the Information Systems department was made the director of the Core Team and given the new title, "Manager of MRP II."

Because MRP II would affect all the departments in the plant work organization, the Core Team had representatives from all the major functional areas in the plant--Information Systems, Finance, Engineering, Marketing, and Manufacturing. However, those two in-plant organizations most directly concerned with employee attitudes and morale--Employee Relations and the local union--played only a marginal role. According to the manager of MRP II, "Employee Relations participated on and off, but they didn't really seem interested." And, while the plant union had asked that a representative be allowed to attend the Core Team deliberations, "he came to a couple of meetings and then dropped out."

The union representative remembers things differently. He says that the union's major concern was to learn what MRP would mean for the graded salary clerks and expeditors. In the early days of the MRP II project, "the message I got from the Core Team was that the people were going to be doing the decision-making." Reassured, he waited to be informed of the meetings dealing with the specifics of implementation, only to discover that he was excluded from them. He claims that, contrary to the impressions of the manager of MRP, the union sought to play an active role in the Core Team, but the structure of the team made this especially difficult. Even with support from Employee Relations, the idea of union participation was never fully accepted.

As a result, the primary focus of the team's work was not the organizational issues of MRP II but the technical issues of how to choose a system and get it into place. According to one team member, there was very little discussion about worker roles in MRP or about the estimated impacts of the system. "We weren't sure what we were getting into," he says. "We knew there were going to be changes but we weren't sure what they were going to be. We were very unsure what the impacts would be."

During the summer of 1983, an internal consultant from corporate headquarters came to the Aircraft Instruments Plant to help the Core Team select a vendor for the MRP II system. Under his direction, the team identified the requirements of the system they hoped to acquire, developed a "request for proposals" outlining the system specifications, and formulated a methodology for evaluating vendor systems. During the month of August, they carefully examined four MRP II systems on the market, before choosing the package of a major computer manufacturer with considerable experience in manufacturing industry.

Costs and Benefits

In order to justify the major investment that this new system would represent, the Core Team also had to produce a "Plant Appropriation Request" setting out the estimated costs and benefits of the entire technological change project. This document was completed in December 1983.

Estimating the costs of the new system was relatively straightforward--a combination of the one-time costs of computer hardware, software, and facilities; plus yearly maintenance and service fees and labor costs. Out of the two million dollar initial investment, about 80 percent went towards hardware (applications software costs, by contrast, were one tenth the costs of the hardware). The team estimated that MRP II would cost some 1.7 million in expenses over three years--$600,000 in maintenance and service fees, the remainder in training and labor costs. The total appropriation was just under four million dollars for a three-year period.

According to corporate policy, approval for major investment projects depends upon those projects making back their original costs in a reasonable period of time (normally, three to five years). However, the benefits of MRP II were considerably more difficult to estimate with any accuracy. The manager of the MRP II project admits that predicting benefits was "all guesswork." While the different categories of benefit were relatively easy to identify, affixing precise dollar figures to these categories was not.

For example, one of the savings from MRP would be to give the Aircraft Instruments Plant control over its data-processing operations, instead of having to depend on the corporate computer center in Utica, New York. This is not exactly a saving for the corporation as a whole (as one Core Team member said, "it's all their money anyway"), but organizationally, it is a real benefit for Aircraft Instruments.

Nevertheless, it was necessary for the Core Team to establish a formula to arrive at dollar figures for the savings that MRP II would produce. The team adopted the approach that savings would be, in the words of the MRP manager, "conservative in magnitude but aggressive in timing" (i.e., the first gains from the project would be moderate but they would happen quickly). The representative from the finance department on the team used a computer program which matched the labor costs associated with each product with business forecasts for the up-coming five-year period and information from companies who had successfully implemented MRP in order to come up with estimated savings in inventory and manpower.

One important area of savings was the ability of MRP II to radically reduce both the levels of inventory in the plant and the speed with which inventory moved through the plant. Normally, inventory represents 20 percent of the carrying costs of the plant. With MRP II, the Core Team estimated, this figure would be substantially reduced. Overall, savings due to reduced inventory would constitute 31 percent of MRP II's total financial benefits.

But by far the greatest savings from MRP II, the Core Team estimated, would be in the area of labor costs--a full 67 percent of the new system's total savings. According to the team's figures, MRP would allow Aircraft Instruments management to lay off 130 people (a tenth of the plant's total workforce) over a five-year period. When attrition is figured in to the equation, the overall reduction of personnel could approach 250 people, nearly 20 percent of the current workforce.

Many of these reductions would be in the area of Production Planning and Control. According to the manager of the MRP II project, with the new system, "the role of the expeditor, as we know it, goes away." Says another manager involved in the Core Team: "Most of the people in Production Support, their functionality will disappear."

The Plant Appropriations Request reflects the narrow approach to organizational issues typical of the MRP II project at the Aircraft Instruments Plant. While Wight and other experts have emphasized that MRP should not be considered primarily as a means to lower labor costs, this document suggests that reducing "head count" was the major justification for the new system. When pressed, Core Team managers will say that the purpose is not so much to lay-off workers as to increase productivity without increasing workforce levels. "You could always re-train people," says a Core Team manager, "try to give them the wherewithal to exercise judgment." However, the actions of the team suggest that lay-offs, not mere "stabilization" are part of their scenario for MRP. For example, section managers were asked by the Core Team member responsible for estimating head-count reductions to identify positions in their departments that could be eliminated. And, while each of the major departments in the plant reviewed and approved the Plant Appropriation Request, the local union was not informed of these major long-term impacts of the new system.

However, it should be emphasized that none of these potential cost savings have occured as of yet. According to the Plant Appropriations Request, the company will not be able to see the effects of these savings until at least June 1985. And, in the face of the considerable problems that subsequently developed during the implementation and use of the system in KD-9, the manager of the MRP II project believes that the system's benefits will begin even later than the Core Team originally expected.

Structure Review

Upon receiving final approval for their project, the Core Team selected the KD-9 operation of the "Flight" product line as the "pilot" for the new system. At this point, the work of MRP implementation began in earnest. Before the system could be introduced into the KD-9 shop, two important tasks had to be accomplished. The first was an intensive review of the KD-9 production process known as the "structure review," in order to establish the "levels" of the product and identify its "routing" through the shop.

Since this data would be the foundation on which the entire MRP system would run, it was absolutely crucial to get it right. The Manager of MRP II calls it the "recipe" for the entire production planning and control system. Members of the Core Team did intensive interviewing in the KD-9 shop itself to learn precisely how Shop Operations manufactured the part. They planned changes in the production process, systematizing shop procedures so that they corresponded to the logic of MRP. The Manufacturing Enginnering department prepared "engineering changes" which accurately documented the newly rationalized production process. Finally, the systems designers of the Information Systems department organized this data for loading into the computer and, once the hardware arrived from the manufacturer (in April 1984), began writing the applications software for the system.

Training

At the same time, the Core Team had to begin training both the managers and supervisory personnel involved in implementing the system and the Production Support and KD-9 workforce itself. Training is probably the most important of the organizational issues associated with MRP. "Training is just as critical as the technical issues," says a systems designer and member of the Core Team. "After all, the users are going to be the ones to make it work. That's where the productivity gains are going to be felt." However, from the beginning, the MRP training process at the Aircraft Instruments Plant encountered serious problems.

Originally, the Core Team had recommended that a manager be hired and given full-time responsibility for training on the MRP project. However, top management rejected the proposal as too costly. "You need a very sophisticated person to do the training," says the systems designer. "He has to be someone who understands both the system and its applications and the user environment. But that's a very hard thing to get top management to accept." As a result, "training fell back on the same people who were trying to make things happen in the first place"--i.e., the members of the Core Team and the designers of the Information Systems department. "But we're so preoccupied with getting the system in and working," the systems designer continues, "that training is falling through the cracks."

On the surface, the quantity of training provided managers and workers at the Aircraft Instruments Plant seems considerable. Some personnel attended a week-long MRP training course at the nearby factory of the system vendor. A first group of 16 managers (the members of the Core Team and systems designers from the Information Systems department) took the course in late 1983. Then, a second group (more systems designers and some supervisors and hourly personnel from Production Support) attended in

February 1984. (Other Aircraft Instruments personnel would attend two more sessions of this course later in the year.)

The training for most of the affected workforce was a 10-week, 40-hour in-plant course developed by the Core Team and the Information Systems department. Consisting of twenty two-hour sessions, the course had three parts: video-tapes outlining the basic concepts of MRP II (purchased from the Oliver Wight Association for $34,000); presentations by Information Systems personnel explaining how the specific system purchased by the plant operated; and hands-on training on computer terminals in order to learn the codes and procedures of the new system.

However, this training program proved far from adequate. Some key workers didn't receive the appropriate training until well after MRP was implemented in KD-9. For example, the supervisor of Production Control for the Flight product line, who first began in that position in February 1984 with little previous experience of the job, did not receive the week-long vendor training until December--four months after the new system had been implemented.

"I was told it would take me away from the office for too long a time and they needed me to stay here," he says. "The attitude was, 'don't worry about it; we'll explain what you have to do.' But when the system finally came in, it was 'do this,' without any explanation."

A supervisor talks about the inadequacies of the vendor training course: "The training the supervisors get is very critical. Mainly, they teach people the actual interactions for how to run the system. But if you don't know how to use the paper work that comes out of the system, what good is it? Nobody told me how to use those sheets."[16]

Among the people who took the 40-hour in-plant training course, the MRP video-tapes come in for near unanimous criticism. One expeditor calls them "boring;" a production planning clerk says they were "a complete waste of time." A third says, "I looked around the room and half the people were dozing."

"People were more confused coming out of the meetings than going in," says another clerk. "People wanted to learn but it was just like high school. They had us watching these videos twice a week. And then they'd ask us these canned questions which they already knew the answers for. The feeling was, 'o.k., stupid, what's the answer.'"

And, while most workers said they enjoyed the hands-on training at computer terminals where they learned how to use the various computer codes of the MRP system, in general, they felt that the training was superficial, more an exercise in public relations than an occasion to acquire new work skills. "They acted like they wanted to sell it to us," says a Production Planning clerk. "What they wanted was for us to be in agreement. They were very anxious for us to like the system."

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[16] This is an extremely common complaint. Individual after individual tells of the difficulty of using the print-outs generated by the MRP system and the fact that no one has taught them how. When we asked one expeditor what was on the reports he received from the new system, he replied, "To be perfectly honest, I don't know. Because nobody has sit down with me and explained how to use the reports and what they're for."

The Core Team managers and Information Systems department designers admit that MRP training has not been tremendously successful. While it has proved useful in familiarizing workers with the various procedures of the computer system, it has not helped them understand the logic of the new work system based on MRP. "I think, for the most part, what was in the video-tapes went over everybody's head," says the Manager of MRP II. "It was a very passive listening process."

But managers tend to blame the failure of the training on the ignorance of Aircraft Instruments Production Support workers. "In KD-9, we assumed that people were, more or less, at the 'high school' level as far as understanding the production control process," says one systems designer. "We discovered that we had to assume people know nothing. We had thought that at least people understood how the present system worked. But we were wrong." Thus, managers discovered to their surprise that, not only did they have to teach workers the new system, they had to teach them what production control itself really was. "What we're finding in the Core Team," says one manager who is a member, "is that we're so brainwashed by MRP that we've almost become experts at what production control _is_. We're trying to teach managers and supervisors what their job is. And a lot of them are saying, 'oh my god, I didn't realize I was supposed to do that.'"

Needless to say, workers from the Production Support department tend to see things in a different way. It's not that they don't understand how production planning and control works at the Aircraft Instruments Plant. What they understand well is the informal system, how the work process _really_ functions. But they are being asked to learn a highly formalized system radically different from anything they have had experience with before. And it is precisely in educating them in this new system that MRP training at the plant has failed. According to one worker, the attitude of the systems designers is, "I'm not here to train people in ordering. My job is to implement the system." This narrow technocentric attitude has been the primary cause for the poor training in the MRP II project.

The superficial training has come back to haunt the Core Team and Information Systems department. Because training was not done properly and workers have not grasped the logic of the new system, the designers, whose job is to implement the new system, have had to play an on-going support role as well. And, of course, this takes valuable resources and time away from implementation in new product lines. The result is a kind of vicious circle: Because of the pressure to "get the system in," training is neglected. Because training is neglected, getting the system in becomes all the more difficult and pressure on systems personnel mounts. They end up not only implementing the system but supporting it once it is implemented. This is one dramatic example of how new work roles must be developed simultaneously with new work tools.

Members of the Core Team say they have learned from their mistakes in KD-9 and that training for the other product lines is significantly improved. Our observations make us skeptical. At one training session for personnel from a product line scheduled for implementation, we observed a trainer give a two hour presentation on some basic rules and concepts of MRP. Afterwards, we asked him how much of his presentation he thought got across to his audience. "Oh, about 20 percent," he said. Also, the MRP II project is not making use of experienced workers from KD-9 to help ease the technological change process in other product lines. One KD-9 supervisor has met with supervisors from other product lines to tell them what to expect--but entirely on his own initiative. And some Production Support personnel and shop floor workers feel that the systems designers, imbued with their own idea of what production planning and control should be, are unwilling to listen to the people who actually do the work. "They don't know the procedures of ordering," says one. "They like to give you the impression that they listen to people, but they don't."

THE IMPACTS OF MRP II

The "Wildness of Converting"

In August 1984, three basic modules of the MRP II system ("Inventory Record Management," "Manufacturing Data Control," and "Material Requirements Planning") went on-line in the KD-9 shop.[17] For the next two weeks, production of the gyroscope came almost to a complete halt. "Implementation was a complete and utter culture shock," says the manager of MRP II, "from which KD-9 still hasn't recovered."

The problems in KD-9 during the first weeks of implementation had to do with what one might call "rigidities" created by the shift from an informal production planning and control system to a highly formal system. For example, under IMS, once a customer order was released into the shop, it stayed on the floor until completed. In addition, there were many accumulations of general purpose "floor stock" in the shop--commonly used items on-hand to meet shortages or replace damaged or otherwise defective components.

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[17] During the time we conducted interviews at the Aircraft Instruments Plant, the same modules would be implemented in the "Thermocouple" and "Flow-Meter" product line. Three other modules of the system ("Capacity Requirements Planning," "Master Production Schedule," and "Statistical Forecasting") had yet to be introduced. Their implementation (as well as that of modules designed for purchasing and marketing) was planned for 1985.

According to the MRP system, however, each time one level of assembly for a particular product is completed, the new sub-assembly goes back to the locked stockroom where its new status is fed into the computer. There is no general floor stock; every single component is accounted for, "mortgaged" to a specific order number (that is, a level of assembly for a particular product), and otherwise placed under strict control.

Thus, to prepare for implementation in KD-9, all of the previously used floor stock had to be returned to the stockroom where it was catalogued, entered in the computer, and stored for future use. And this became the source of an organizational problem. Amidst the numerous pressures of preparing KD-9 for MRP, cataloguing this general purpose floor stock became a relatively low priority for the design team. However, when it came to actually building the KD-9 product, this heretofore easily accessible floor stock turned out to be far more important than the system designers had ever thought.

When the newly functioning MRP II system began releasing its first components onto the KD-9 shop floor, many of these supposedly "excess" parts (yet to be entered into the computer or even properly organized in the stockroom) were missed. And in their absence, the KD-9 gyroscope simply could not be made. "It was supposed to be a clean sweep," says the unit manager of the KD-9 shop, "but not all the parts we needed were picked. So, we couldn't start up on Monday. In fact, that whole first week, we couldn't do anything. I had people sitting around screaming for something to do." It took anywhere from one to two weeks to get the required material to workers on the shop floor.

To make matters worse, supervisors in the KD-9 assembly area were still responsible for meeting their normal monthly production quotas--even as they struggled with the difficult and time-consuming MRP implementation process. The work performance of all supervisors at the Aircraft Instruments Plant is evaluated according to whether or not the supervisors' areas meet specified monthly dollar targets, the amount and value of the products they "get out the door." It was as if no one in the plant's upper management had considered the fact that, in the words of one KD-9 supervisor, "when you first run the systme, you're bound to lose production. You can't avoid it. We started on a Monday and, by that Friday, we were already 68 units behind."

In effect, shop supervisors were caught in a double bind. They were responsible for getting MRP implemented and for meeting their usual quotas as well. It was an impossible situation in which they were held hostage to delays over which they had little control.

Eventually KD-9's floor stock problem was resolved. But what the unit manager calls "the wildness of converting" can serve as a kind of metaphor for the on-going problems with the the MRP II system at the Aircraft Instruments Plant: on the one hand, the substantial "mis-match" between the logic of the MRP system, programmed in the software of the computer, and the complex realities of the KD-9 production process; on the other, the clash between traditional managerial policies and incentives at the plant and the organizational practices and roles necessary to make MRP work.

The System vs. Production

The MRP II system is an elaborate simulation of the KD-9 work process. As such, it gives managers access to vast quantities of information never available before. It is this access to new information that managers say is the greatest benefit of the new system. For example, a shop supervisor in KD-9 says, "it's perfect for me to plan my work. I can find out through the system exactly where an order is." "The system makes a real engineer out of you," says a stock room employee, enthusiastically. "I can find anything I want to know from the terminal. It's like a genie!"

However, despite the sophistication of MRP II as an information system, as a production planning and control system, it is often too "rigid" or too "simplistic" to adequately reflect the complexities of production on the shop floor. As a result, the managers and workers in the KD-9 shop, as well as the supervisors and clerical personnel in the Production Support office, all have to devise ways to do "end-runs" around the system, simply in order to get the work done. Or, as one dispatcher from the KD-9 shop puts it: "If you want to keep people working--and they do want to work, believe it or not--you have to cheat the system."

Thus, even as MRP "formalizes" the previous informal production planning and control system, the Aircraft Instruments Plant is witnessing the creation of a new informal system, in which the role of the worker is to handle those frequent situations where the computer system, however technically sophisticated, is too crudely programmed to respond to the complexities of the real world. The qualities of this new informal system are best viewed, first, from the perspective of the KD-9 shop, then, from that of the Production Support office.

In KD-9, "there are probably more problems with MRP than there are benefits at the moment," says the shop supervisor. The major reason is that the usual shop production process has been forced to adapt to the logic of MRP rather than the other way around--adapting MRP to the special characteristics of KD-9 gyroscope production. Thus, the computer system has often become an obstacle to getting work done rather than an aid. The unit manager of the KD-9 shop thinks it would make more sense to shape the procedures of MRP to the special needs of the work process. But "until that restructuring is done, one of the things we've been doing is going around the system, while always telling the system what we're doing." Instead of being automatically released by the MRP computer system, nearly all the parts used in KD-9 are currently being manually released--the shop supervisor estimates as many as 95 percent.

There are any number of examples of this "going around the system." One concerns the standard MRP practice of not releasing a level of assembly into the shop until all the components required to complete that level are present in the stockroom. At first, this makes a kind of superficial sense. After all, why release a level and start assembling it if you don't have all the components necessary to put the particular sub-assembly together?

However, in many cases, there are orders which the system refuses to release, due to missing components, that in fact should be started in production. For example, there is a top cap that goes on a part called the "heading gyro" (one sub-assembly of the KD-9 gyroscope) at the very end of the part's assembly process. "You could go through and built the whole thing over a three week period before you would even need to think about that top cap," explains a shop floor "gyro analyst" in KD-9. But, because the entire heading gyro constitutes one "level" in the KD-9 production process, MRP holds back all the components for the gyro if there is a shortage of top caps--even though considerable work can be done on the part in the caps' absence.

Now, of course, the MRP II system could be programmed to reflect this peculiarity of the heading gyro assembly process. Why not distinguish among the various components of a particular level depending on when they are used in assembly? In fact, the designers of the Information Systems department say they are working on such a program to incorporate "lag days" into the system, which would allow MRP to release some of the components for a particular level, whenever it calculates that, by the time workers are ready for the later components, they will have arrived. But until such a feature is available, the assembly workers must go to their supervisor, and he must go to the Production Support office, where the Production Planning and Production Control supervisors have the sole authority to over-ride the MRP schedule.

Another example concerns the relatively common work process of "cycling." At many points in the production process, the elements of the KD-9 gyro are subjected to rigorous temperature tests, where they "cycle" back and forth between extremes of heat and cold over many hours. Cycling is a time-consuming operation, sometimes lasting as long as sixteen hours. It accounts for much of the time that the KD-9 gyroscope is in production. It is also a highly automatic process; basically, the part can be left alone cycling in a special oven for hours at a time.

The KD-9 shop supervisor tells a story where, after completing one level of assembly, the product must be returned to the stockroom, its order number changed to reflect the next highest level, and, upon release by the MRP system, put directly into a cycling operation. However, when the first level is completed late in the afternoon, one usually has to wait until the next day for the computer to process the completion of one "order" and the "release" of the next higher level components. In the meantime, precious time is lost. Instead of cycling overnight, the product sits in the locked stockroom, waiting for the computer to process and release it.

Once again, the supervisor handles this situation manually in order to speed up the production planning and control process. He goes to the Production Support office and explains the situation; they release the part manually, knowing that the computer will "allow" them to do tomorrow what they have already done today.

A related problem has to do with week-ends. "I am constantly in trouble," explains the KD-9 shop supervisor. "We run a seven-day operation around here. Many changes happen over the weekend." However, on week-ends, the stockroom is closed and the MRP system is down. What happens if the assembly of a particular level is completed over the week-end?

To avoid having to stop altogether (because the completed stage cannot be returned to the stock-room or components for the next level released by the system), on Friday the supervisor and programmers from the Information Systems department try to estimate what steps in the production process can be completed over the week-end, then feed those steps into the system as if they are already done, which allows MRP to release the parts for the next levels. As the month comes to its end and the shop has to hustle to meet its montly out-put quotas, this Friday afternoon end-run process can become an enormous task. "The last two week-ends of the month are utter chaos around here," says the shop supervisor. "We try to stay ahead of it. It's a guessing-game. It's crazy!"

Another area where MRP can cause difficulties and delays is that of "replacement parts." Under IMS, the "pick" for a particular customer order would usually include some extra parts in case any components were scrapped in the course of production. Also, there were the "floor stocks" of commonly used parts kept in the shop itself to handle sudden shortages. With MRP, however, the control of components is considerably tighter. The floor stocks have been eliminated. While the system has the capacity to program extra parts into orders, workers in KD-9 say that "picks" are getting tighter. And, most important, each specific set of components is targeted to a specific order. "Before, I'd usually have a whole mess of extra parts on hand," says a KD-9 gyro analyst. "With this computer, the controls on the stock are very tight. I don't have any buffer."

In the past, if there were, say, two slightly damaged sub-assemblies in a certain shop order, workers could always combine the best components of each of them so as to have at least one working part. With MRP, this option is impossible because the specific components are "mortgaged" in the system to a particular assembly.[18]

The normal procedure for replacing damaged parts is to file a "replacement request." The worker goes to the KD-9 shop dispatcher and fills out a form. The dispatcher takes the form to the Production Control supervisor who signs it, then takes it back to the worker. The worker gives the form to the stockroom clerk who then releases the replacement part. "And, one hour later, I might have to do the same thing all over again," says the gyro analyst.

What the gyro analyst doesn't say is that, if the dispatcher simply made the "replacement request" via his terminal through the system, it might take even longer. One dispatcher claims that the process of meeting with the personnel from Production Support and the stockroom speeds up the entire process. "If I ran what I did completely honest," he says, "it would take two to three days to get a replacement part. Usually, it takes me about half an hour. The trick is, finding the right people. They don't question my motives when I ask for a replacement part, because they trust me." Thus, negotiation and personal relationships have yet to eliminated entirely from the production planning and control process.

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[18] At least, formally. When we asked one gyro analyst whether he went ahead and "cannabalized" parts in this fashion anyway, he said, "I'm not going to say that! But, sometime, you just do what has to be done. Without a certain amount of running around the system, you'd lose days." Another example of the new informal system.

However, the ultimate result of the replacement request process is to impair the shop's ability to respond to scrap problems. Says the KD-9 shop supervisor: "You could waste a day, day-and-a-half, waiting for a replacement part to get on the floor. My recovery time is diminished."

One final example of the mis-match between system and production process is "rework"--when the KD-9 gyroscope has to go back to an earlier stage of production, because something isn't functioning properly. For a product as technologically complex as the KD-9 gyro, this is a relatively common experience. The shop supervisor estimates that, at any one time, nearly 50 percent of the products in the shop are moving backward for rework rather than forward for further assembly.

But this creates an enormous problems for workers on the shop-floor who have to fill out vouchers detailing the work they have performed which are, then, fed into the computer system so MRP knows where a particular order is in the assembly process. "I don't think they understood the complexity of the product," says the supervisor. For there is no easy way to record a product moving back to an earlier level of assembly. As a result, "MRP has no idea where it is," the supervisor continues. "That's a big inaccuracy and, to me, that's bad. At any given point, the system can give you an untrue picture."

Product Knowledge

There is an important conclusion to be drawn from all these examples. Instead of eliminating the need for traditional "product knowledge," MRP makes that knowledge more necessary and more important than ever before. This statement goes against the grain of most assumptions about computerized automation. It is common to think that technological change makes traditional expertise and knowledge obsolete, replacing them with new expertise and new skills associated with the computer. Workplace computer systems do demand new kinds of expertise on the part of workers (as the following discussion of "system knowledge" suggests). However, this does not mean that traditional work knowledge becomes unnecessary. At the Aircraft Instruments Plant, it is crucial both to the effective use of MRP and to efficient production on the shop floor.

At the stage of MRP implementation, knowledge about the intricacies of the product is important in order to ensure that the MRP simulation is as accurate as possible. If systems designers and manufacturing engineers don't get the "routing" right, the problems that occur after implementation can be enormous. The KD-9 shop supervisor estimates that only about ten percent of the routings in the shop are wrong, but in some cases whole steps of assembly are left out. "I saw the pressure they put on those engineers when they did the routing," says the supervisor.

"So, of course, there were mistakes. Product knowledge is important, especially at the beginning."

The KD-9 unit manager and the supervisor also complain about the lack of on-going technical support provided by the Manufacturing Engineering department. The original engineer who supervised the routing has since left the company. And the engineers assigned to the KD-9 shop now have never been trained on the computer and have only recently learned how to change the routing on the system.

Product knowledge is also crucial to the functioning of the shop itself. Supervisors have to have sufficient familiarity with the product they are manufacturing to know when to ask that the MRP system be manually altered. "You have to be educated enough to know the product line," says the KD-9 supervisor. "That goes against all these new principles of management which say that the supervisor doesn't have to know the product, he only has to know how to manage people."

Finally, product knowledge is _especially_ important for the supervisors of Production Planning and Control. Under the new system, they are the people with the authority to manually release orders. This presents another organizational problem of the MRP II system at the Aircraft Instruments Plant. According to the unit manager and supervisor in the KD-9 shop, the lack of product knowledge on the part of Production Support personnel has been a major barrier to the success of the new system.

Because they do not understand the constraints of the shop floor, KD-9 shop employees claim, Production Support personnel sometimes do not see the problems that the MRP is creating. In other cases, their dependence on the picture of production provided by the computer system leads them to assume there are problems where, in fact, there are none. "In many cases, Production Control should be able to say, 'oh, I should release that,'" explains the KD-9 unit manager. "But they don't have the product knowledge to know when to do it. So, my supervisor feels that he is constantly doing their job. He cannot release orders, so he is always going to them. In his mind, they should be able to do it themselves."

This shift of authority from the shop floor to the Production Support office (exacerbated by the perception that the people in Production Support don't know how to perform their job effectively) has led some KD-9 employees to see MRP as a threat to their own control. "Before, you could use your own judgment," says one gyro analyst. "Now, you have to do it according to the rules. You're losing control over your product. It's always going back to the stockroom, whereas it should be in the assembly person's hands." About MRP, this worker says, "We've learned to operate in spite of it. I feel that, eventually, we'll be able to function pretty good, but in spite of MPR rather than because of it. I feel it's a burden. I don't see where it's any help to my job."

Monitoring Worker Performance

Another way that KD-9 workers lose control under MRP is the capacity of the system to monitor work performance more closely than ever before. Not only does the new system keep better track of parts as they move through the KD-9 production process. It also provides highly detailed information about worker performance at every step of production. "They are really monitored and it's getting worse," says a supervisor about workers in the KD-9 area. "The accountability from the employee to me is becoming more stringent now. They cannot lie. The system won't allow them to lie."

Traditionally, workers in the KD-9 shop have had to fill out daily "vouchers" detailing the jobs they have worked on and how much time they have spent on each of them. This is a common practice throughout industry, especially at workplaces like the Aircraft Instruments Plant where workers perform a wide variety of tasks on a number of different products. Vouchers give companies a rough bench-mark for determining the labor costs of their products.

However, daily vouchers are a crude measurement at best of what workers actually do each day. There is wide latitude for both over-estimating and under-estimating the time spent performing specific tasks--whether deliberately or inadvertently. And this gives workers the ability to control, or at least influence, the information that management receives about how long it takes to perform certain jobs.

However, because MRP II divides the work process into precise "levels" or steps and, each time a specific level is completed, the information is recorded in the computer, the system exerts a far more rigid control over workers' actions. In addition to their daily vouchers, employees have to turn in "Milestone Cards" (known as "M-cards") at specific steps throughout the production process, and the information on these cards is immediately entered into the system by the dispatcher in the shop. This new information, available through the computer, provides management with a far more realistic picture of what goes on on the shop floor.

Take the example of "variances"--the comparison between how long a particular step in the production process is supposed to take (in other words, its "lead time") and the time it actually takes in a specific case. One of the key jobs of supervision is to make sure that workers' variances stay low--i.e., that actual performance comes as close as possible to the official lead times for each level of production. Using the reports generated by the MRP system, a supervisor can determine exactly how long each step has taken; he no longer has to depend on the individual worker's estimate. "I can sit down at a glance and find specific people and whether they are over or under budget," says the KD-9 supervisor. One result has been that, since the implementation of MRP II in the KD-9 shop, variances have gone from being between $190 and $300 per person over budget to approximately $30 to $40 per person.

Another example of how the system increases managerial control over workers is "responsibility reporting"--a comparison of what work is actually performed each day with what workers say they have done. In the past, it was extremely difficult to evaluate employees' statements on their voucher cards. But, with MRP, it is impossible to have any discrepancy between what the worker does and what he reports. The computer immediately flags any difference and will not allow the worker to sign off on a job until the discrepancy is rectified. And when the "Shop Floor Control" module of the MRP II system is fully implemented, the control that the system exercises over worker performance will become even more complete.

According to the KD-9 supervisor, there has been some dissatisfaction among shop workers about the tight controls of the MRP II system. "People have panicked," he says. "They're saying, 'big brother is watching us.'" It is a sentiment that he can appreciate, for the controls of the new system not only affect workers; they affect the shop supervisor as well. Under IMS, his performance was evaluated based on a combination of factors such as overtime costs, rework costs, and the number of products he got out the door. With MRP, it has become much easier for the accountants of the Finance department to calculate these variables. "They've got us right around the neck," says the supervisor. "Before, we could lie like a son of a bitch. But, now, everything in that room they know about."

Supervisors do not complain about the existence of these detailed measures as much as they do about the existence of two seemingly contradictory evaluation and incentive systems. On the one hand, there are the traditional monthly dollar targets; on the other, the new bench-marks of the MRP schedule. Both supervisors and workers are told to work according to the MRP schedule. But, at the end of every month, if there is any chance that they will fall short of achieving the monthly quota, the schedule goes out the window as shop workers rush to get out as many "high value" items as they can in order to meet their dollar targets.

"We are all measured in dollars," explains a Production Support manager. "But that makes a prostitute out of you. And it goes against the whole idea of MRP. We should be measured by how close we are sticking to the schedule." Interestingly enough, a member of the manageral Core Team agrees. The problem, he says, is that "The general manager is a real dollars and cents man."[19]

System Knowledge

What some KD-9 employees experience as a burden, the supervisory personnel of the Production Support office tend to see as a solution to a persistent problem. Once a customer order is put on the old IMS system, product line supervisors have a great deal of discretion in deciding when to manufacture it. The stockroom is open and supervisors can release "picks" on their own authority. Also, other departments, such as marketing, can find ways to go around Production Support in order to hurry along those parts in which they have a special interest.

MRP, however, puts Production Support at the center of the production planning and control procedure. It makes it very difficult for other departments to maneuver around Production Support. Now, everything runs to the MRP system, and control over the system rests primarily with Production Support. For any changes in the system or revisions of its schedule, all departments have to come to the Production Support office.

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[19] It should be pointed out that this is not a "technical" problem. There is no inherent contradiction between the idea of working to the MRP schedule and that of meeting monthly dollar targets. Indeed, were the MRP system to be programmed to include financial data about the costs of parts and products, the schedule itself could be automatically adjusted to ensure that monthly targets are met. The problem is organizational--specifically, the fact that management has proceeded with the MRP system without thinking through how best to shape evaluation and incentive systems to fit with it. The result is an incoherent and contradictory system of incentives that obstructs employees' adaptation to the new system rather than encouraging it.

"MRP stops people from going around Production Control and expediting things on their own," says a Production Control supervisor. "Under MRP, when they get an order, that order has got to go through. We have a lot more control over materials than we did before. If they want something changed, they have to come to us." Says a Producton Planning supervisor, "We have to hand-spoon these guys."

For one thing, MRP II provides Production Support personnel with far more information about where parts are located in the factory than the IMS system did. Not only is the MRP schedule generated twice each week. But the information on the terminal screen is far more accurate and up-to-date than the previous system. As a result, it is much harder for parts to simply disappear. Instead of going out to the factory to find out whether the system's information is accurate, Production Support employees can depend more on the terminal screen.

However, this is not to say that, with the MRP II system, production planning and control become somehow "automatic" or that the Production Support personnel become entirely unnecessary. Because they are the people who need to know how and when to perform end-runs around the system, their judgment and expertise are the key to MRP's effective use. As one supervisor of Production Planning puts it, "MRP isn't just a matter of punching keys."

Consider the example of "lot sizes." Normally, the parts for a particular customer order will be ordered and released in specific numbers or "lots," spread out over time. This is one way to avoid the costly accumulation of inventory in the plant at any one time. A Production Planning supervisor describes a hypothetical situation where there are only eight pieces of an available component for a lot size that is, normally, ten. The system will not release the order until at least two more components arrive. But it is better to have eight components in production than zero. The current lot-size should be changed to eight and the next lot-size to twelve. Making these kind of decisions is the responsibility of Production Support.

"As long as it's an economical size, you do it," says the Production Planning supervisor. "You have to look at the report every day and be able to know when to manually release orders and when not to. If you just let it be set by the system, you'd never get going out there. You have to use some common sense and logic."

Another example is the phenomenon of "push outs." Each time the MRP II system "reschedules" part orders (currently, this takes place twice a week), it changes the "due dates" of certain components. It can turn out that a particular OV part will not be needed as soon as was originally thought. When this happens, the system tells Production Support to do a "push out"--i.e., to renegotiate the delivery date of the component with the vendor. The principle of "push out" is to save money by keeping material out of inventory until it is absolutely necessary that it be there.

The problem is that, in certain situations, the part being "pushed out" can be so cheap or the period of delay so brief that it would probably cost more in labor to organize the paper-work and deal with the vendor than the procedure would ever save in reduced inventory. Once again, it is the job of Production Support to "temper the system with common sense."[20]

In other words, the clerks and supervisors of the Production Support office function as a kind of human check on the operation of the MRP II system. Their job is to complement the sometimes too rigid operation of the system, to increase its flexibility so that the "special cases" which fall through its insufficiently fine software net aren't lost altogether. In order to perform this job effectively, this requires the "product knowledge" that personnel from KD-9 talk about. But it also requires something else: what might be called "system knowledge" of how MRP functions.

It is not sufficient that Production Support personnel simply "follow the rules" of the new MRP II system. They need to know how to creatively "bend" or "manipulate" those rules so that things get done in the most efficient way possible. This involves knowing how to move back and forth from the logic of the computer system to the logic of production (what the Production Planning supervisor calls "common sense"). Indeed, it requires coming up with the best fit between these two parallel but often quite different systems.

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[20] This is another example where the system could be programmed to include this kind of information but has not yet been.

We witnessed a small but revealing example of this process in the course of an interview with the supervisor of Production Planning for the Flight product line. Our conversation was interrupted by two supervisors from the stockroom with a question about some recently discovered "overlays" (a kind of blue-print) found in the stockroom. What the stockroom supervisors needed to know was, not where the overlays belonged in the stockroom (they were already there), but how to "send" them there by means of the MRP computer system. There ensued a long discussion about the overlays--where they were found, where they were now, how they were currently recorded on the system. Supervisor B asked if Supervisor A should "release" the overlays to him, at which point, the Production Planning supervisor replied, "he should only give them to you if you have them."

The comment appears rather cryptic but there is an explanation for it. The supervisor was talking simultaneously about two "systems"--that of the stockroom and that of the computer. Supervisor B already has the overlays. But the task is to get the system to show that.

So, he must be "given" by computer the overlays that he already has been given by hand.

This example is not all that dissimilar from that of the KD-9 shop supervisor and systems designer, on a Friday afternoon, programming the completion of certain orders in advance so components will be released and work will able to be completed over the week-end. The task is trying to get the computer to match an already-existing real situation or, put another way, describing the real situation in a way that is acceptable to the rules of the MRP II system. Without workers with such skills, the computer system and the shop floor reality will, almost inevitably, come into conflict.

This raises yet another potential organizational problem for the MRP II system at the Aircraft Instruments Plant. It could be that, with all their talk of getting people to work to the system, the managers of the MRP II project are conceiving the work disciplines required by the new system far too narrowly. If these disciplines are understood primarily as "following the rules of the system," then they may themselves become a barrier to developing the kind of judgment skills, product knowledge, and system knowledge on which the ultimate success of MRP II depends.

There are some indications that workers and their supervisors are receiving contradictory signals from the Core Team and the Information Systems department about just how to function with MRP II. Our conversation with the Production Planning supervisor from Flight suggests how:

"In case after case," he told us, "you have to say, 'forget you, system.'" We asked him if that meant his job was, in a sense, to "second-guess the system."

"Don't say 'second-guess,'" he quickly responded, "because that drives the Information Systems people crazy. What it is is good common sense. Making judgments. They're always telling us, 'the system only suggests; it doesn't run the show; it's up to you to decide.' Of course, when you don't do what the system says, they're up here saying, 'what the hell are you doing?'"

Terminal Work

Perhaps the most visible change brought about by the MRP II system has been the substantial increase in time that Production Support personnel spend actually working at computer terminals. One Production Planning supervisor estimates that his time at the terminal has tripled since the introduction of the new system. A Production Control supervisor says, "More than anything else, this has changed my job a great deal. I feel like I'm sitting at that terminal all day." Currently, he spends anywhere from 40 to 60 percent of his time in front of the computer screen, "and it's growing more and more." A G-11 production control clerk in the contributing areas adds, "once the other product lines are on MRP, I can envision just living on the terminal."

There are many reasons for this increase in terminal time. As employees in the various Production Support offices become responsible for their own data, many of the data entry tasks originally performed by a separate department are now being done by clerks--for example, the Production Planning clerks who, twice a week, feed schedule changes into the system. Also, while the old IMS system has terminals as well, Production Support personnel use them primarily to collect information. With MRP, they need to work on the terminals, not only to gather information but also to perform actual transactions--for example, "releasing" parts onto the shop floor. Finally, many Production Support workers and managers say that the design of the computer print-outs generated by the MRP II system is poor and not very useful for them as they perform their work. This forces them to work at the terminal in order to collect information they need which is unavailable from the print outs.[21]

Whatever the precise reason for this increase in terminal time, many Production Support workers and managers share the same metaphor for describing it. They say that they are becoming, in the words of a Production Planning supervisor, "glorified key-punchers." "We always had a terminal before," he explains, "but we used it more for an information base. Now, we're using it for work. We're running all kinds of transactions on the system."

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[21] One theory that explains this rather common complaint is that, according to the logic of MRP, workers do not really need this information in order to do their jobs. However, Production Support personnel claim that, when it comes to the realities of the shop floor, such information is crucial in order to effectively handle the exceptions that fall through the net of the MRP system.

This image of Production Support personnel being turned into "glorified key-punchers" needs qualifying. While some of the tasks associated with the MRP II system are data entry functions, it would be a mistake to equate the terminal work required by MRP with the routine and monotonous tasks usually associated with key-punching. As previous sections have made clear, working with MRP II requires Production Support personnel to exercise judgment, to utilize knowledge and expertise about both the product and the computer system itself. These are skills that go far beyond those necessary for data entry.

And yet, this is not to say that, when people talk about becoming "glorifed key-punchers," they are wholly mistaken. For this phrase seems to be their way of describing the peculiar quality of work on video display terminals--in particular, its abstract and often boring character. Indeed, what may distinguish work with the new MRP II system is precisely this combination of the imperative of exercising initiative and judgment with the boring realities of abstract terminal work.

There is a growing literature in the study of what one researcher has called "computer-mediated" work which explores some of the implications of this combination.[22] On the one hand, working with complex computer systems requires that workers "follow the rules," stick to a set of specific routines or procedures. On the other, working with these systems also can demand a constant alertness--"paying attention"--in order to identify and handle exceptions. Some researchers have speculated that this contradictory combination poses a unique psycho-social dilemma: How to maintain one's alertness while performing tasks that are highly abstract and, at times, downright boring? Such a work situation can prove extremely stressful to the individual worker; and, if not managed correctly, it can also become an obstacle to the effectiveness of the overall work organization.

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[22] Zuboff, op. cit., Adler, op. cit.

However, this is not an issue that Information Systems management at the Aircraft Instruments Plant has considered. Their failure to do so has tended to exacerbate the contradiction between the pressures of heavy terminal work and the sense of initiative necessary to perform the production planning and control job effectively. Consider the example of "ergonomics"--the proper design of computer work stations and computer systems for human use.

In recent years, there has been a growing recognition on the part of both computer technology vendors and users that the "ergonomics" of work station design is a crucial factor for both worker job satisfaction and corporate organizational effectiveness.[23] However, this message has yet to reach the "industrial office" of the Aircraft Instruments Plant factory. When we asked the manager of the MRP II project about the role of ergonomics, he said, "I'm not so sympathetic with the point of view that says, 'gee, I'd like this a lot better if that column were on the right rather than on the left.' I personally have never had any problem with that kind of thing."

This is a rather narrow view of ergonomics. Unfortunately, it is apparent throughout the entire MRP II project. Our observations suggest that there has been virtually no thought to the design of computer terminals, work stations, or Production Support offices. Terminals have been placed through-out already-existing offices, assembly areas, and stockrooms. Lighting is poor and desks and chairs are inadequate. For example, while Production Support managers and supervisors have received ergonomically designed office chairs, clerks and expeditors who also use terminals have not.

But the biggest problem of all is that there simply aren't enough terminals to handle the work to be done on them. As a result, workers have to compete for access to terminals under extremely poor conditions. In the

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[23] See, inter alia, Olov Ostberg, "CRTs pose health problems for operators," International Journal of Occupational Health and Safety, November-December 1975, pp. 24-52, and Gunn Johansson, "Computer Technology: Stress and Health Relevant Transformations of Psychosocial Work Environments," in Human-Computer Interaction edited by G. Salvendy (Amsterdam, 1984).

Production Support office serving the contributing areas, there is only one terminal for six people. "We have to fight like hell over it," says one G-11. "It's like a zoo in there." In order to use the terminal, this particular production control clerk has to rotate it 180 degrees so it is facing his desk. And, because of the poor lighting, there is a constant glare on the screen when he uses it.

Due to these poor working conditions, a number of the Production Support personnel whom we interviewed voiced a variety of health complaints that seem to be related to their heavy terminal work on the MRP II system:

"Sometimes, your eyes get buggy after awhile," says a Production Planning clerk. "It's very difficult to look at that screen all day."

"I'm convinced that, the way things are going with MRP, I'm going to go blind," adds a Production Control clerk who has recently had to get his first prescription for eyeglasses.

"Looking at the screen a lot, your eyes sort of get tired," says a Production Control supervisor. And when we informed him about some of the medical findings concerning the relationship between constant VDT-work and a variety of health complaints such as eye-strain, headaches, and backaches, he laughed and told about some back problems he had experienced the day before after long hours of working at the terminal. "It never dawned on me that it could be from sitting there all that time," he said.

In the absence of a full-fledged health survey, it is extremely difficult to determine just how widespread such complaints may be. Nevertheless, given the increased terminal work that MRP II involves, it seems likely that this anecdotal evidence reflects an underlying problem with potentially serious implications for the Aircraft Instruments Plant work organization. The ergonomics example represents yet another case where the organizational dimension of technological change has been ignored.

Who Does the Work?

MRP II has not only meant a shift in authority from Shop Operations to Production Support. It is also changing the balance of responsibilities between managerial personnel--in particular, supervisors--and the graded salary personnel of the union bargaining unit. With the implementation of MRP, there seems to be a corresponding migration of work tasks toward supervisory personnel and away from union workers. Such a change could have wide-ranging implications. If the introduction of the MRP II system eventually results in the substantial labor savings that Core Team managers predict, then the fact that it is primarily managerial personnel who are working with the new system could mean that the jobs of union workers will be most at risk. In the words of one Production Control supervisor, "The big question around here is, 'who's going to do what?' We're all looking to a cut-back. But nothing has been decided yet."

At the time of our interviews at the Aircraft Instruments Plant, those people who worked most regularly and most directly with the new MRP system were Production Support supervisors. They make the judgments that effective operation of MRP requires. They decide when to perform end-runs around the system. They even perform many of the basic transactions that make the new system function. According to one Production Control supervisor, there has been a "hesitancy" on the part of management at the Aircraft Instruments Plant "about letting the people do it"--i.e., giving bargaining unit workers the responsibility for major system tasks. As a result, most of the Production Support clerks and expeditors we interviewed have been relatively isolated from the day-to-day workings of MRP. When we asked one expeditor what his boss did on the new system, he replied, "I don't want to say what he's using it for, because I'm not really sure."

To the degree that graded salary personnel are working with the new system, it is usually at their supervisors' discretion and only to perform the lowest level clerical tasks--entering data into the computer, for example, or translating information currently on the IMS system to the new format necessary for MRP. "In actuality, there is an awful lot of clerical file maintenance and data maintenance that has to be done," explains one member of the management Core Team. "The supervisors are doing nearly all of the judgmental work right now, and they're giving the clerical data entry work to the graded people."

However, managers claim that this state of affairs is only temporary, that eventually some of the higher level tasks will be delegated to graded salary personnel. "At some point, we want to transfer some of that judgment-making to the people who can handle it," continues the Core Team manager. "One of the things we're doing now is trying to assess whether people can hack it or not."

The union at the Aircraft Instruments Plant takes a less optimistic view. It sees this division of labor between supervisory and union personnel as a contradiction of the work organization model presented by the Core Team in MRP training and an attack on the integrity of the G-11 job classification (the highest of the unionized salary grades). "We were all told that the G-11s would be 'decision-makers,'" says the union representative to the Core Team. "If there was anything that Oliver Wight [the management consultant on MRP who produced the videotapes used in the training course] drove home, it was 'let the people do it.' We all agreed with that. But now, in the implementation, they've created another level of management.. And these managers have all created supervisory staffs underneath them. I get the impression that these supervisors are going to be the real decision-makers. It's almost an obvious attempt to eliminate the G-11s."

This process is nowhere more clear than in the Production Support department serving the four contributing areas that supply "make" parts to the Aircraft Instrument product lines.[24] Traditionally, the G-11 "production control clerk" in this department has been among the most skilled of the plant's graded salary personnel. "The job that I have used to have some authority to it," says one G-11. "We used to plan, order material, put it out on the floor, see that it was properly machined and inspected, put it back into stock. We had the authority to see it happen. Before the foremen were foremen; they took care of the people and we took care that the work was in the shop and processed through on time. But, with MRP, they've taken away practically all the skills that used to be in the job. Now, we've been reduced to a clerk-type status."

The actual technology of the new MRP system certainly has played some role in this process. The more accurate and up-to-date information provided by MRP makes it unnecessary for the G-11s in the contributing areas to spend a great deal of time determining the status of orders on the shop floor. But it would be a mistake to explain this particular worker's sense of being turned into a "clerk" entirely as an impact of technological change. For, parallel to the implementation of the MRP II system (and, in some cases, even prior to it), there have been a number of organizational changes at the Aircraft Instruments Plant that have also greatly affected the shape and content of the G-11's job.

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[24] Because the KD-9 product line receives parts from two contributing areas, the machine shop and the coil shop, the following description is based on developments in those shops alone. As MRP II spreads to the other product lines of the Aircraft Instruments Plant, we assume that workers in other contributing areas will see the same organizational and technological changes.

In January 1984, seven months before the implementation of MRP in KD-9, there was a broad re-organization of the Production Support function at the Aircraft Instruments Plant. What previously had been a centralized work organization was decentralized, and a separate Production Support office was established for each section of the plant. In addition to creating a specific Production Support manager for the contributing areas, the re-organization also established new Production Support supervisors for each of the four contributing shops. According to the Production Support manager in the contributing areas, this addition of supervisory personnel was done with the expressed purpose of gearing up for the transition to MRP. Later in the year, just before the implementation of MRP in KD-9, yet another tier of supervisors was added to the contributing areas. The position of "shop co-ordinator," reporting to the manager of manufacturing, was created in the machine and coil shops and given responsibility for scheduling and promising, tasks previously performed by the G-11s from Production Support.

Thus, many of the traditional tasks of the G-11s have disappeared in the course of the past year. Some have been subsumed into the computer system itself. Others have been taken over by the new supervisors in the Production Support office. Still others are performed by the shop co-ordinators. And the G-11s have been left with clerical tasks that are repetitious and, in some cases, even pointless.

One G-11 describes an illustrative case in point: Perhaps the most common complaint about MRP among department managers is that, while the system reports provide information on the "due dates" of parts--i.e., when they need to be completed and passed on to the next step of production--they do not display information on "release dates"--the time when the parts actually arrive in a particular shop. In many cases, the main reason why a supervisor will miss his due date is because the parts necessary to complete a particular level of production are not available to him (and, therefore, not released by the system) until it is too late.

This can be a major problem for the supervisor, because his performance is often evaluated by upper management according to how successfully he meets his due dates. So, it has become common practice throughout the plant for supervisors to keep parallel records of when jobs actually start in their shops, so that, in the words of the Production Support manager in the contributing areas, "when I get a call or make a presentation on MRP and some manager says, 'how come you're 37 percent delinquent?' I'll have something to say back to him. It's all 'PYA'--protect your ass."

The primary task on MRP performed by one G-11 was to search out the information on the terminal so that his manager could put together this list of "release dates." "A lot of what I do is just exercises, really," he says, "gathering information and writing it down so that some supervisor or manager can read it. I don't see anything in MRP as it is now organized which gives any decision-making power to the G-11s."

What is the logic behind this organizational change? It appears that Aircraft Instruments Plant management is operating under two basic assumptions. The first is that MRP II will require significantly fewer people to oversee production planning and control (this assumption is described in detail in the Plant Appropriation Request). The second is that, because of the centrality of MRP to the entire plant work organization, it is essential that those people who do work on the system be management personnel. "They tell me I can't be held accountable," says one G-11. "What that really means is, I'm not part of supervision."

This approach would seem to contradict some of the common advice about MRP systems, such as Oliver Wight's recommendation to "let the people do it." However, the idea of maximizing management personnel and responsibilities, at the expense of the union bargaining unit has a long tradition at the corporation of which the Aircraft

Instruments Plant is a part. It seems that plant management is using MRP II, not merely to improve production efficiency but also to expand the parameters of managerial control.

It is too early to say whether or not this organizational model of a small, primarily management workforce responsible for operating the MRP II system is a feasible one for the Aircraft Instruments Plant. However, what is certainly clear is that, so far, the transition to this new work organization has been anything but smooth. The G-11s at the plant are 10- and 15-year veterans of the production planning and control work process. They are highly skilled with a wealth of experience of how things actually work in the plant. Many of the new supervisors occupying the newly created positions described above are young with almost no experience in production planning and control. At the time we conducted our interviews at the Aircraft Instruments Plant, the manager of manufacturing in the machine and coil shops had been on the job for six months, the machine shop co-ordinator for two. The position of coil shop co-ordinator had been advertised but not yet filled. And some of the Production Support supervisors had been on the job for less than six months.

Because the MRP system is still not entirely implemented and because the vast majority of parts are still released manually anyway, through end-runs around the system, these young inexperienced supervisors have confronted problems that they do not have the expertise to handle. This, too, has disrupted the production process. For example, the Production Support G-11 assigned to the coil shop has been forbidden to do any promising or scheduling, but in the absence of a coil shop "co-ordinator" some 115 parts are in process in the shop without having been "promised out" to the product lines. "I don't really know where they're headed," says the G-11. "No one is promising. How they have any visibility about the final product and when it's getting out, I have no idea!"

In the machine shop, there is a full-time co-ordinator. But, until MRP is fully implemented, no one individual can do the job of keeping track of some 700 separate parts at any one time. Thus, the G-11 from Production Support asssigned to the machine shop is still performing the tasks of scheduling and promising--only informally. "I'm still doing the same old thing," he says. "I make all the commitments. The only thing is, I'm doing it unofficially. I pass the information on to the co-ordinator and he gets all the credit for it!"

When they speculate about their future, most G-11s think they will end up as mere expeditors. "I get the impression that I'm going to be an expeditor," says one. "The supervisor will now be responsible for scheduling the areas. And I'll be the middle-man, conveying those promises to Production Control." Says another: "All that your production control people will be doing is expediting material into the house from OV, and into the stockroom and out onto the machine shop floor so they can build the product." But there are two problems with this scenario. According to the Core Team, a major goal of MRP II is to eliminate the necessity for expediting altogether. And, to the degree that there will always be a need for what one manager calls "runners" between the various Production Support offices and between the contributing areas and the product lines, there is already the occupational category of the G-9 expeditors whose job description matches this function. Thus, it is unclear whether the G-11 occupational category will have any role to play in the fully implemented MRP II production planning and control system.

It is important to emphasize that the final organization of work with the MRP II system is not yet fixed. It is still too early to know whether a work organization based on a small group of relatively young supervisors can effectively oversee production planning and control at the plant. The plant union seems to think that there may even be a conflict within Aircraft Instruments management as to whether to entrust responsibility for working the system to bargaining unit workers or to reserve it within management.[25] And, whatever management's hopes for the new system may ultimately be, the very demands of efficient production may call for an active role for skilled graded salary workers in operating MRP II.

At the very least, one can say that the promise of increased decision-making for graded salary workers has so far remained unfulfilled--and not merely because of the technology itself, but because of managerial decisions about how that technology is organized and used. In their own effort to influence those decisions, the G-11s of the Production Support office in the contributing areas filed a grievance in September 1984, claiming that the assignment of scheduling to the new "co-ordinator" position was a case of management doing bargaining unit work and, thus, a violation of the union contract. The grievance is still under consideration.

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[25]Signs of this conflict have emerged since we completed our interviews at the Aircraft Instruments Plant. In January 1985, management announced a lay-off of eleven people concentrated in the graded salary positions of the Production Support department. In no way did MRP II cause these lay-offs. However, management decisions about who was to be laid off seem to reflect the (mistaken) belief that the system allows the plant to do without a number of graded salary personnel. This is a potentially disastrous decision, in that in leaves the plant without experienced production planning and control personnel precisely at the moment when it may need them the most.

On the other hand, the Employee Relations department has recently informed the union of the possibility of assigning new graded salary personnel to Production Support in order to get MRP II working properly. Of course, whether such a move would indicate a real commitment to allowing union workers to operate the system or whether it would merely be a stop-gap measure to ensure the smooth functioning of production planning and control functions until MRP II is entirely implemented remains to be seen.

CONCLUSION

The story of MRP II at the Aircraft Instruments Plant suggests that technological change is a social process. When people talk about the "impacts" of new workplace technology, they are really referring to the social and organizational choices which shape not only the effects that technology has on people and organizations but the ultimate effectiveness of technology itself.

Because the people who usually make these decisions are corporate managers, technology consultants tend to emphasize the importance of top management leadership and involvement in any major technological change project. For example, MRP consultant Oliver Wight argues that, "Without the leadership to establish and maintain a new set of values in an organization so that [it] can operate effectively with a formal system, a company will never achieve the potential of MRP. Any company attempting to install MRP without top management understanding and leadership would be well advised to *stop*."[26]

It is precisely the lack of attention on the part of management at the Aircraft Instruments Plant to this social and organizational dimension of technological change that has been the source of so many problems in the MRP II project. Neither MRP project management nor plant management as a whole has thought through the implications of this new system for the plant work organization--what it means for work roles, for plant incentive systems, for labor-management relations, and the like.

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[26] Wight, *op. cit.*, p. 127.

In these pages, we have provided numerous examples of how managerial choices have become a major obstacle to the successful implementation and use of MRP II. Despite management's rhetoric of MRP as a "people system," management practice has reflected a narrowly "technocentric" approach to what is, in fact, a complex organizational change. Implementation has been considered primarily a matter of "getting the system in" rather than a plantwide re-organization of work roles. Training has been conceived and organized to teach people the functions of the new MRP II computer system without adequately educating them in the overall logic of MRP or helping them to develop the complex skills and responsbilities necessary for its effective operation. And, once MRP II has been put into operation, management has not addressed a vareity of sharp contradictions between the new system and traditional work practices, job categories, and plant incentive systems.

Aircraft Instruments Plant managers claim that the organizational problems that have plagued the MRP II project are transitional. For example, the manager of MRP II admits that, "KD-9 really hurt us," but he feels that organizational obstacles are being resolved as the Core Team learns from its early mistakes. Speaking of the implementation of MRP in the Thermocouple product line (the second to receive the new system), he continues, "we are trying hard to generate a success story. We want to encourage enthusiasm and active listening."

According to this point of view, once any number of further tasks are accomplished--for example, once the remaining modules are in place, or once the production backlog is eliminated and the product lines catch up to the MRP schedule, or once the Core Team figures out the proper work roles to accompany the new system--then MRP will work as smoothly as it is supposed to. It is just a matter of time.

However, veteran Production Support workers in the plant offer a different scenario--the pessimistic belief that it may already be too late. "From what I understand about MRP," says one expeditor, "it is supposed to make the system run perfectly. But, from what I've seen of it so far, it's not working that way. Now, don't get me wrong. I'm not knocking computers. But, you know, 'Garbage In, Garbage Out,' and there seems to be a lot of garbage going in recently!"

In order to understand this shop floor pessimism, it is necessary to grasp how Production Support workers see themselves and their role in the plant. Many of these employees are plant veterans with 15- , 20- , and 25-year service and more. In sharp contrast to managers and supervisors, who are constantly being rotated from job to job inside the plant and, often, out of the plant altogether, there is very little turnover among this workforce. This has helped create an attitude of "professionalism." As one production planning clerk says, "We're the only real professionals here."

At times, this attitude seems to imply that no system could possibly replace the Production Support workforce. This perspective is, in fact, extreme. But many workers are convinced that management has not taken advantage of their skills and their expertise in implementing the system. Indeed, they feel that the system is not for them at all; rather, it is a play-thing of management. "The people who have designed the system so far," says a Production Control clerk, "have left me with the impression that it is built so that the guy on top can see what he wants to see. And the guy below, well, let him struggle with it. There has been little, if any, thought to the people who actually have to use the system. It's not 'user-friendly' at all."

Perhaps the most thoughtful expression of the pessimistic scenario came from on Production Support worker who has been assigned to the Information Systems department as a kind of go-between with the Production Support workforce. Working in close contact with the systems personnel, he has witnessed some of the most serious problems affecting the MRP II project. He puts the on-going failure of the project at the feet of the systems personnel responsible for MRP implementation.

"MRP II is a people project," he begins. "The people have got to get involved in it." But this is precisely what *the Core Team and the system designers, despite their* rhetoric, have not done. "They go down there and hold classes for a few weeks and think people understand it," the worker continues. "But they don't. I'm the guy who actually goes into the workplace after the training courses, the systems people don't. I'm the one who sees the guy who can't read the report. I see what the real world is like."

He tells a story of meeting with the Production Support staff for the Thermocouple product line. All the key systems designers were there. During the meeting, the people from Thermocouple said that everything was fine. But afterwards, they approached this worker to tell him what the real problems were. Such a gap in communication reflects the on-going failure of MRP project management to effectively solicit worker commitment, feed-back, and support. It is a failure that continues to plague the MRP II system at the Aircraft Instruments Plant.

"I'd love to see the system work," says this worker. "We've got to have it work. Maybe after a year or two, when all the modules are in place, people will have learned the job. Give the systems people the benefit of the doubt. But I doubt it. Because they don't know how to get the people involvement. They're pushing the panic button down there. They're in trouble. They're looking at the tree and not seeing the forest. These guys are walking down the yellow-brick road."

Which scenario for the future of the MRP II system at the Aircraft Instruments Plant will prevail? It is impossible to know for sure. However, it should be emphasized that the difficulties experienced by project managers in the past two years are far from being unique. Indeed, they represent some of the most common problems that work organizations experience when designing and implementing new office technologies. And their resolution depends far less on narrow technical factors than on the social and organizational processes by which workplace technological change is managed and negotiated.

Office Automation in an International Banking Department:
A Case Study

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The Organization of Work with Integrated Office Systems: A Case Study in Commercial Banking

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The Organization of Work with Integrated Office Systems: A Case Study in Commercial Banking

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Table of Contents

1. Introduction 1
    1.1. Background and Literature Review 1
    1.2. Approach to the Study 4
2. Method 6
3. Study Setting 9
    3.1. Corporate Strategy 9
    3.2. Corporate Culture 11
    3.3. International Department 12
    3.4. The Asia/Pacific Group 13
    3.5. Technology Department 14
4. Asia/Pacific Group's Business Problem 15
5. Office Information System (OIS) 16
    5.1. Design Objectives and Implementation Strategy 18
    5.2. System Description 20
    5.3. Implementation Schedule 23
    5.4. Cost 23
6. How OIS is Used 24
7. What has Changed 26
    7.1. Job Content and Skill Level 26
    7.2. Structural Arrangements 29
    7.3. Communication 30
    7.4. Work Location 32
    7.5. Supervision and Performance Measures 33
    7.6. Power 34
    7.7. Employment Levels 34
    7.8. Performance and Cost 34
8. Implementation of OIS 36
    8.1. Expectations 39
    8.2. Reasons for Outcomes 39
    8.3. Suggestions for Improvement 40
9. Interpretation of Events 41
10. Policy Issues Raised by the Study 42
    10.1. Issues 42
    10.2. Paradoxes 44
    10.3. Postscript 48
11. Comparisons with Prior Research 48
12. Conclusion 51
I. I 53
I.1. Goals 53
I.2. Questions 53
II. II 55

1. Introduction

Although the use of computer and communications technology in offices has been proclaimed as *the* major change in work settings anticipated during the 1980's [Bikson 81, Mankin 78] and it is predicted that over 50% of the the total work force will be affected [Bair 78], relatively little is known about the consequences of its adoption. This paper describes an exploratory study of integrated office technology in a commercial bank, with particular emphasis on the resulting changes in structure and content of office work.

1.1. Background and Literature Review

It is sometimes argued, as routine office work is transferred to computer systems, that the remaining jobs will have increased content, involve greater opportunities for learning and require higher levels of skill than previously [Shepard 77, Connell 79]. Equally frequently it is suggested that use of this technology will result in deskilling of office jobs, for example, through increased specialization, or decreased autonomy and interaction with other workers [Braverman 74, Gregory 83]. Some point out that, with the introduction of technology, there is a tendency in capitalistic societies to reorganize work at lower levels of skill than before [Attewell 82]. Others note that effects are likely to be different for different job levels; routine clerical jobs will become deskilled while managerial jobs become enhanced, or the reverse. More recently it has been maintained that information technology is neutral; the values of its implementors and designers, and the social context in which it is employed determine the impacts on work organization [Olson 85, Kling 80]. This last theme suggests the importance of *implementation* in determining outcomes.

There are various perspectives on implementation, each suggesting its own set of critical factors and issues. The most obvious is *technological and economic determinism*, where the character of the work is derived from the job to be done, the nature of the technology available and the structure of economic interests [Ginzberg 79]. A second approach stresses *contextual factors*: environmental, organizational and cultural [Lucas 81]. Another perspective, highlighting the *process of implementation*, focuses on political interests, `turf' and the re-allocation of power among key actors [Keen 81, Markus 83]. A fourth theme sees *social systems* and their patterns of norms, information flow and control as being dominant [Kling 84].

Another interesting and somewhat related approach to implementation is provided by the *innovation* literature [Bikson 81]. The *R&D* model proposes an explicitly rational process leading from scientific inquiry to adoption and employment. Here, users needs are the goal of the innovation process. The *problem-solving* model has users needs as the starting point of the process. Innovation is seen as a problem-solving activity that "progresses from experienced and diagnosed needs, through information search and decision making, to trial and evaluation." Bikson concludes that innovation outcomes turn mainly on the "situational characteristics" of particular organizational contexts. Factors to be considered include: reason for adoption, involvement of key actors, incentives, adaptive planning, user participation, and training.

As Laudon [Laudon 85] observes, most explanations of implementation rely on either *environmental* or *institutional* models of organizational change. Environmental models consider exogenous uncertainties and opportunities which organizations must either cope with or take advantage of in order to survive. Institutional models, in contrast, focus on endogenous factors, which are partially under organizational control and are often the result of past actions, for example, organizational culture, the values of key stakeholders, or social structure. Laudon believes that organizations are driven to adopt information technology largely because of environmental factors. The extent to which information technology is actually utilized and the specific ways in which it is implemented is, however, determined mostly by institutional factors.

These latter approaches have much in common. They conceive of outcomes as resulting from the interplay between the characteristics of the available technology, economic considerations, contextual factors, political realities and social pressures. It is this view of innovation that has been adopted for this study.

One final theme needs mentioning. Most authors agree that office information systems should improve productivity, through reductions in cost or by improvements in worker performance [Poppel 82]. Studies substantiating this notion, however, are rare.

1.2. Approach to the Study

The general approach that has been taken in the study of office work is to describe what workers do in offices and then, based on the capabilities and characteristics of a particular technology, project the likely payoffs and consequences when they use that technology [Uhlig 79, Poppel 82]. The difficulty with this strategy is that it assumes work will be organized in the *same* manner as before and that workers will be performing the *same* tasks. This need not be the case. The most important consequences of using technology in offices come through changes in the context of work and how it is structured, and may be unexpected. For this reason, more exploratory studies are needed to identify variables of interest, to formulate more precisely questions for further investigation and to raise policy issues.

There have been relatively few studies of actual systems in real work settings. Those that have been made consist in either the evaluation of a specific product or the determination of how well the goals of an organization have been met [Matteis 79, Uhlig 79, Crawford 82]. These studies are often performed by the developers of the system themselves, raising questions of bias.

Some work has been done in evaluating the *individual* components of office systems, for example text editing [Card 83] or electronic mail [Crawford 82], treating them as though they were independent. Integrated office systems that provide a wide range of features, however, have not been studied in detail.

Communications and information technology have been applied to the following office functions:

- Internal mail
- External mail
- Text preparation
- Filing
- Information retrieval
- Conferencing
- Office applications, including scheduling, telephone and calendar management
- Decision support
- Access to operational application systems

An integrated office system, then, would consist of all, or at least a large number of the above functions.

While there is little agreement as to what the term *integration* constitutes, the suggestion is that it goes beyond multifunctionality to include:

- The use of the same name, semantics and method of invocation for common functions among the parts of a system. For example, the command for saving a file would be the same in the mail sub-system as in text preparation, and the functions would be identical.

- A product, worked on in one part of a system, is available in all others.

- It is relatively easy to move among the parts of a system without taking special action. For example, one can move between mail and text preparation sub-systems without being concerned about saving a file, exiting from one sub-system and entering another.

- Navigational information on status and location is provided.

- The system is open-ended so that new functions or sub-systems can be added easily.

Consequently, an integrated office system provides a common interface to a wide variety of office functions and is, potentially, a more complete tool than any of the component parts. Thus, the effects should be more pronounced than those associated with any one of the parts.

This study investigates the changes that have taken place in the Asia/Pacific Group of the Bankers Trust Company after the introduction of an integrated office system. Considerable attention is given to the *process* of implementation and to changes in outcomes.

2. Method

The boundary of the situation being studied includes one department of a major financial institution, consisting of about 2000 employees, and those portions of other departments (mostly certain members of the Technology and Operations departments) that were directly involved in the system implementation. Geographically, the department is dispersed world wide with headquarters of about 60 in New York City, sharing the same building as the Corporate Executive, and with well over 60% of its staff permanently assigned to field offices in major financial centers around the world, the majority of them in Asia. Staff are routinely rotated back to New York for training and re-assignment.

The unit of analysis for this study is the individual worker, although some conclusions are drawn about work group, departmental and organizational processes.

Semi-structured interviews, memoranda and observations were the primary method of data gathering.

Respondents were selected from all levels of the department, ranging from clerical to department head, based upon their having participated in the implementation and their formal position in the organization. For purposes of verification, where possible, at least two subjects were selected from each work group and from each organizational role. Although the researcher was unable to travel abroad, a sufficient number of workers who had been in the field at the time of implementation were available in New York to not make this a limitation.

An open ended interview selection process was used. If, in the course of an interview, a person was mentioned as having played a key role in the implementation, that name was added to the list of interviewees. The more senior personnel were interviewed last to permit the identification of critical policy issues. Table 2-1 provides a summary of respondents by organizational level.

Interviews centered on five facets of work:

* *The process of implementation*. The events that occurred and the role that the respondent played.

* *The technical system*. The features used, purposes for which they were used and the respondent's attitudes about the system.

* *The job*. The tasks performed, how these had changed from before the system was implemented and the likely causes of these changes.

* *Interactions with others*. The ways in which

Table 2-1: Interviewees by Organizational Level

Level	Interviewees [number]
Organization	Department Executive [1] Technology Department [3]
Group	Heads [2] Division Heads [1] Team Heads [2] Key Actors [2]
Individual	Officers [5] Support [4]
Total	[20]

interactions and relations with other workers, supervisors and principals had changed and the likely reasons for these changes.

* *Policy issues*. Attitudes about issues that have potential policy overtones for workers, the use of this technology, or the bank.

A copy of the interview protocol has been provided as Appendix I. Subjects were interviewed by the researcher, in sessions lasting from 30 to 60 minutes with the last portion devoted to unstructured items, either those that the respondent cared to raise or amplification of items that emerged during the interview. They were conducted from October 1984 through June 1985.

Informal feedback sessions were held with selected individuals and groups to assure that conclusions reached in the analysis were realistic.

3. Study Setting

Bankers Trust Company, with over 45 billion dollars in total assets, ranks as the country's tenth largest commercial bank employing some 10,400 people, world-wide. Several years ago, Bankers Trust embarked on a strategy to shift the emphasis of their business from retail to *wholesale* financial services, prompting them to withdraw from certain businesses, such as retail banking, that did not fit this new image.

3.1. Corporate Strategy

In refining their wholesale financial services strategy, Bankers Trust made return on average common equity (ROE) their primary financial target, partially because it permits comparisons with non-bank financial companies. Bankers Trust's current goal is a ROE of $20 on each $100 of common equity [Bankers 84]. In 1984, the return was $16.20, up from $16.16 in 1983 [Bankers 84]. Stockholders equity increased to $2.1 billion, up from $1.6 billion in 1983 and 1.4 billion in 1982 [Bankers 84]. Since 1977, equity has grown by more than $1.3 billion, largely through high earnings performance, by judiciously taking advantage of capital market opportunities and through decisions consistent with their wholesale strategy. The continued growth in equity reflects the belief that capital strength is indispensable for successful competition in the wholesale financial services industry.

Along with the emphasis on equity has come an intense effort to control non-interest expense while maintaining a commitment to operating quality. Over the past six years, growth of operating expense has increased at an average annual rate of 11%, as compared with 16% for a composite of the nine largest commercial banks in the United States. Several tactics have been responsible for maintaining this downward pressure on expenses, among them, the controlled application of technology, particularly in labor intensive areas, and the institution of an internal expense budgeting system. The latter links all expenses directly to related revenue streams, clarifying the selection of trade-offs when managing expense growth. Through this system, internal expenses between departments are billed directly to user departments, just as outside vendors would bill them. Consequently, ultimate accountability for expense control rests with income producing user groups, which have clear incentives to decrease unproductive expenses and to increase productive ones.

The third component of Bankers Trust's approach has been to manage credit exposure by pricing that compensates for the degree of risk taken. In 1983, the ratio of net charge-offs to average loans fell to .20%, down from .45% in 1982 [Bankers 83]. Moreover, the allowance for loan losses has increased and now stands at 1.5% of total loans [Bankers 84].

The ongoing refinement of Bankers Trust's wholesale strategy has led to a new sort of financial institution - a world-wide *merchant bank*, meeting customer needs with innovative, sophisticated and profitable services. The merchant banking strategy seeks to combine on-balance-sheet lending capabilities and breadth of non-credit services of a commercial bank with intermediary skills, flexibility and entrepreneurial spirit of an investment bank.

Trading strength and the ability to distribute securities and financial instruments are the cornerstone of merchant banking. Bankers Trust is one of the five largest primary U.S. government securities dealers, as well as one of the five leaders among bankers acceptance dealers. They also rank in the top six investment banks in the commercial paper field. Last year marked the emergence of BT Futures Corp, a separate entity offering its customers institutional hedging and trading techniques using futures and options on futures, in the interest rate, currency and precious metals markets.

3.2. Corporate Culture

In contrast to their innovative approach to competition in financial markets and their aggressive change in corporate direction, Bankers Trust remains a conservative company that will not take action unless it can see a clear benefit. It is a company that doesn't take a risk unless it is absolutely necessary. While new blood has been brought in from Wall street and amply rewarded, the majority of the staff are bankers operating under the old rules. It is this conflict between risk taking and risk aversion that is reflected through out the company and gives it part of its schizophrenic character.

Individuals appear competent. Yet, the potential for the organization, taken as a whole, seems greater than what is achieved in practice. Much of what is done at middle and operational levels is not directed at accomplishing business goals. There seems to be an unusual amount of difficulty in translating goals, articulated from the top, into programs that have the support of those in the middle and at the bottom.

Individual workers tend to be myopic; they have difficulty taking an organizational prospective.

3.3. International Department

The International Department (ID) was one of the three groups that made up the Banking Function, the other two being the U.S. Department (banking services for non-multinationals) and World Corporation (banking services for multinationals)[1]. ID was organized geographically, by regions, with four main groups: Asia/Pacific, Latin America/Canada, Europe, and Middle East/Africa. Also part of the department were four service groups: Trade Banking (letters of credit and collections), Syndication, IRMD (international risk management and credit reviews), and Individual Investment Management. For the most part, ID was organized with a regional manager, then a senior country officer with front office, back office and operations support. Although day to day direction came from ID, the organization structure was matrixed with service groups also reporting to their functional parent elsewhere in the company.

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[1] Recently Bankers Trust reorganized, grouping together departments that have significant potential for improving return on equity and they intend to expand aggressively as part of their overall merchant banking strategy. The previous head of the International Department emerged as head of the Global Processing and Information Services Department (GOIS) which performs deposit services, funds transfer, trade payment and collection services on a world-wide basis.

3.4. The Asia/Pacific Group

As part of ID, the Asia/Pacific Group (approximately 300 staff) provided commercial banking services in Asia and the Far East[2]. The group was organized geographically including:

* North Division with headquarters in Hong Kong and offices in Korea, Taiwan, The Peoples Republic of China and the Philippines.

* South Division with headquarters in Singapore and representatives in Bombay, Jakarta, Bangkok and Colombo.

* Japan Division with headquarters and office in Tokyo.

* New York Division with headquarters in New York and consisting of five teams (desks): Japan, Korea, North, South and London. The purpose of these teams was to coordinate activities originating in New York with their respective field offices and to to link the field offices with the appropriate Operations groups in New York.

* Two subsidiaries, BTAL located in Sydney and TISCO in Bangkok.

* Group Credit and Controller staff functions.

The organization chart is shown in Figure 3-1.

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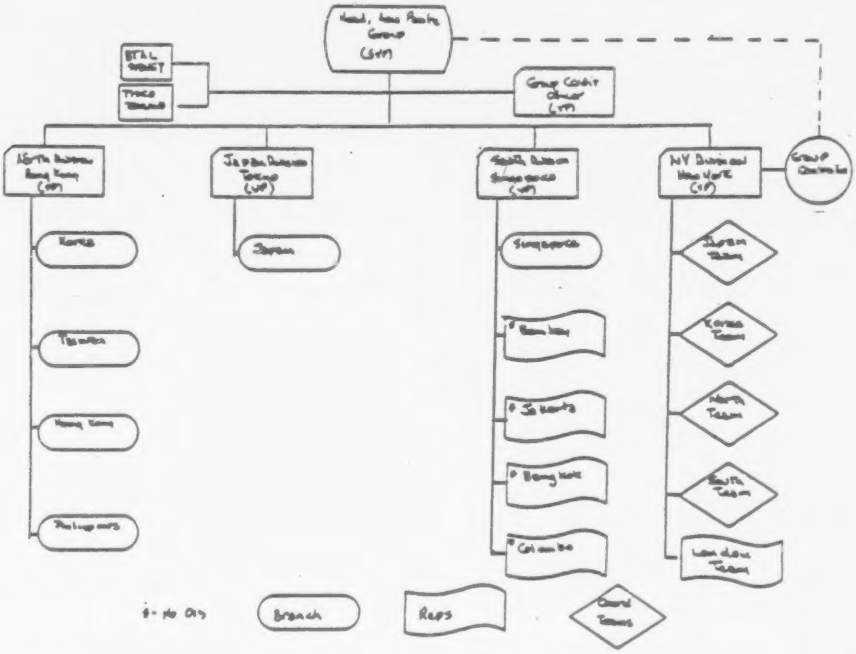
[2] In the recent reorganization, the Asia/Pacific Group became part of the Latin America/Asia Pacific Department of the Commercial Banking Section. The old head of the Asia/Pacific Group has become the deputy head of the new Latin America/Asia Pacific Department.

Figure 3-1: Organization Chart for the Asia/Pacific Group


Head, Asia Pacific Group (SVP)
Group Credit Officer (VP)
North Division Hong Kong (VP)
Japan Division Tokyo (VP)
South Division Singapore (VP)
NY Division New York (VP)
Group Controller
Korea
Taiwan
Hong Kong
Philippines
Japan
Singapore
* Bombay
* Jakarta
* Bangkok
* Colombo
Japan Team
Korea Team
North Team
South Team
London Team
Branch
Reps

3.5. Technology Department

Most of the information systems personnel in the bank, roughly 800, were part of the Computer Systems Department (CSD) which consisted of a variety of groups developing and maintaining most of the bank's computer application systems or running their data centers[3]. CSD's reputation was going through the same type of negative image as were many centralized computer departments in large companies. It was viewed as a traditional COBOL shop; builders of large, transaction processing systems that were often behind schedule, over budget and not particularly responsive to user needs. Yet, as with many similar departments, they were, in their own way, innovators. One of these groups, Information Management Services (IMS), built the system[4].

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[3] Until recently, CSD reported to Banking Operations, but about a year and a half ago the name of the department was changed to the Technology Department (TD) and it now reports at the same level as the other major operating units (to the Executive Committee).

4. Asia/Pacific Group's Business Problem

Almost all of the Asia/Pacific Group's communication, both between New York and the field, and among field offices took place over BITS, the Bankers Trust International TELEX System. TELEX was used because of the need for a hard copy record of the communication on both ends and because time differences restricted greatly the concurrent availability of parties for telephone conversations during the normal business day.

TELEX preparation involved a principal dictating a message to a secretary or giving her handwritten copy. The secretary would then type the message and give it back to the principal for correction. This process was repeated until an error free message was created. The secretary then prepared a TELEX tape for *each* recipient. Copy from each of these tapes was given to the principal for approval after which the secretary actually sat down at the TELEX and transmitted each message.

Not only did this process consume a lot of a principal's and the secretary's time, but it was inefficient, error prone and it discouraged sending messages and information copies, just the behavior opposite of what was desired when putting together a complicated deal where timing and coordination were critical. Frequently, secretaries were required to work overtime just to send messages and principals arranged their daily schedules to insure there would be sufficient time to send messages before the end of the day.

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[4] The IMS Division has been reorganized and is now called Bankers Trust Information Services (BITS). The system is no longer their responsibility, but instead has been placed under a new entity, in TD, Corporate Information and Communications Systems.

Another task involved the need to generate long (15-20 page) loan proposals that had to be sent between Tokyo, Hong Kong, New York and London several times during their preparation.

While it is not clear that the problem was perceived in exactly these terms at its inception, almost everyone believes now that this was the primary reason for going forward with the system[5].

5. Office Information System (OIS)

The possibility of using computer and communications technology to overcome the communications problem in ID, in general, and for the Asia/Pacific Group, in particular, did not escape the heads of the departments. ID was profitable and its head, a forceful executive, with lots of ideas and a willingness to put money behind them, was interested in things that might make them more profitable. He realized the opportunities presented by computer and communications technology and decided to take advantage of them. The wholesale banking strategy rested on cultivating relationships with the most profitable clients, devoting a great deal of effort, for example, to lending and deposit taking. Key to this were representatives in the field being able to craft new and exciting products for their clients and obtaining close support from Operations units and Executive Management, in New York, that would have to approve a deal. Technology could also become a symbol of BT's new, aggressive posture.

---

[5] Many more functions were included in the system than can be explained solely on the basis of improving communications. Clearly, then, some players intended that the system be used for purposed other than communication, for example, to improve the quality of information available, or to alter the content of jobs, or to change the location of where work was performed, etc.

The head of the group knew that poor communications was compromising his people's performance and his ability to control them. As he put it later:

> If you are charged with the responsibility for managing a business that covers fifteen countries, the problems of coordination and communication are of real concern and very crucial to your success. OIS provides us with just the kind of communications link we need to tie together our operation.

There were fewer *champions* within TD, although the head wanted to alter the image of his department. *Office Automation* was a hot topic in the field and the head of IMS was looking for a customer, within the bank, to pilot test an office system. There had been several attempts at office systems in the past, but none of them had sufficient support to be funded. There was general awareness in TD that the bank was not taking advantage of new technology and might be left behind.

5.1. Design Objectives and Implementation Strategy

Initially, it was thought that communicating word processors in each location could handle the job. But the head of ID felt this was too limited an approach. From the beginning, Office Information System (OIS) was intended to be *integrated*, providing a variety of functions, for example, internal and external mail coupled with text preparation, to solve the communications problem, and to access the banks application systems as a way of delivering information directly to people in the field without having to go through middlemen. As conceived, the system would be a vital tool for the working level, but less essential for senior management[6]. In order to ensure that the system worked before being given to users in ID, IMS would *pre*-pilot test the system in its own department.

The concern over controlling expenses meant that the pilot had to be tied to clear cut goals and success factors. For example, the purpose of the pilot was:

to demonstrate that the system is:

- A means for increasing hard-dollar revenue
- A catalyst for behavioral change
- A means of improving internal and external communications
- Financially justifiable in terms of cost savings
- Technologically effective

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[6] One of the original proposals was that the system should be used by only the head of ID and the 8 senior managers reporting to him - essentially an executive support system. This plan was discarded in favor of the approach described, which was much more broadly based, providing support to staff at *all* levels - operatives to executives.

The category of `behavioral change' requires explanation. The culture at the bank made it particularly difficult to alter people's behavior. There were no easy mechanisms for making people aware of the need for change[7]. For example, if TELEXs were sent out in the afternoon, Then it was almost impossible to change this pattern short of a directive from top management. It was realized by some of the players in ID (but not all) that OIS could be used as a vehicle for "discarding some of the bad habits formed over time."

More specific goals in customer service, for example, were "respond to 30% of customer Money Transfer Inquiries from Bankers Trust field locations on the same day that the inquiry is made without reference to Money Transfer Research in new York." Another goal was to "remove Asia/Pacific Group's New York division Customer Service Officer (CSO) from all routine customer inquiries coming from the field."

To accomplish this, OIS was to provide a direct line to the setup and inquiry functions of the Historic Research system (HR). A CSO in an overseas office would be able to respond to customer requests for information on the same day they were made by using their OIS terminal to view full details of the transaction. If desired, a research process could be initiated immediately with HR routing the request to a researcher, thereby shortening the process by two days.

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[7] Schein [Schein 70] refers to this preparatory stage as 'unfreezing'.

Other goals included implementing ID's "close to the customer" strategy and building a data base to assist Relationship Managers in identifying customer needs, in developing and monitoring market plans, and in permitting Product Managers to assess requirements/applicability across units. The time required to complete a loan proposal requiring group level approval was to be reduced by 50% (the current process took 10 days). The overall time required to complete inter-office communication was to be reduced by 30 minutes (from 40 to 10 minutes). Finally, the OIS pilot test was to reduce the amount of time marketing personnel spend on administrative matters by 15%, eliminate 25% of New York based CSO's problem solving work load and replace it by customer contact, and reduce secretarial workload allowing improvements in their officer coverage ratio[8] from .33 to .25, or a 33% improvement.

Just prior to the pilot test, a three month average of BITS traffic going in and out of New York was 159 messages per day and this was growing at about 10% per year. One of the notions was that OIS would be a substitute for BITS and this traffic would decrease.

5.2. System Description

IMS wanted to build the system out of proven technology. After a through evaluation of the available products they selected Digital Equipment Corporation's (DEC) *All-in-One* Office Menu System, which was in prototype testing at the time. The system runs on VAXs under VMS and includes word processing; electronic mail; document processing; desk management, with calendar and calculation; and forms development in one integrated package. The system consists of three components: a flow control facility to allow a VT-100 terminal to select options from a menu to move from one application to another, an application interface providing menu access to an application, and a forms development capability for adding new applications. One of the reasons for selecting All-in-One was the communications architecture of the VAX.

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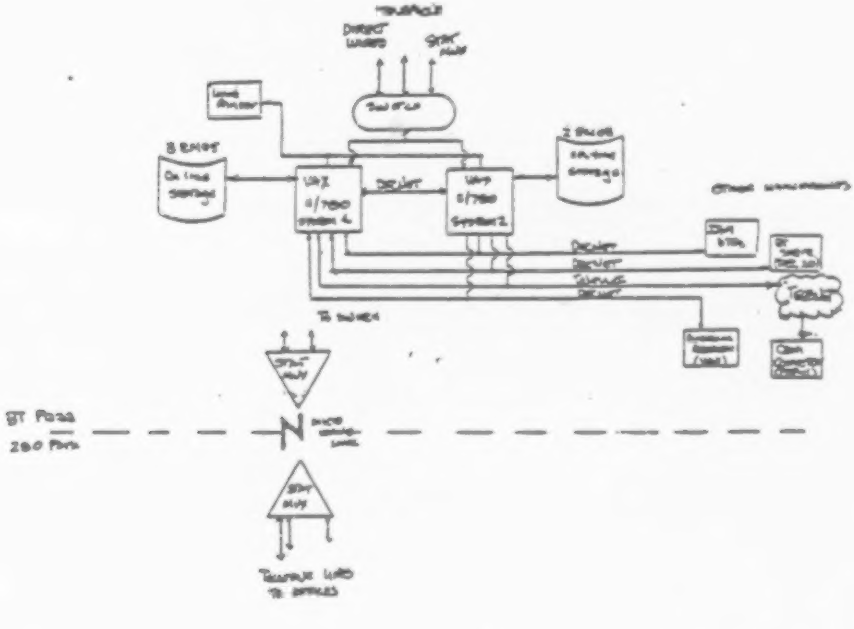
[8] Officer coverage ratio is the number of secretaries in a group divided by the number of officers (principals) in the group.

Figure 5-1 shows the equipment configuration. Two VAX-11/780s, located at BT Plaza, running VMS are connected with a highspeed communications link (DECNET). One system had three spindles of disk storage (256MB each) while the other system had

Figure 5-1: OIS Equipment Configuration



two. Both systems are DECNETed to BTShare, the time sharing system, and run 3270 and 3780 emulation to connect to the bank's IBM-370 computers. There is a DECNET link to another VAX running the Historical Research system and a Telenet line to a PDP-11 running the Cash Connector system. A 72 line statistical multiplexor (STAT MUX) tied to a micro-wave link is used to connect the equipment at BT Plaza to 280 Park Avenue, where ID is located, and dial-up access allows other non-DEC terminals, such as MICOMs and hard copy devices, to communicate with the system. OIS runs on one of the VAXs while the other is used for back-up or development. Terminal transmission speeds are 9600 baud at BT Plaza, 2400 baud at 280 Park Avenue, and 1200 baud over BTNet overseas and dial-up. A Teltone MODEM is used to split the phone line in an office into voice and data reducing installation cost greatly.

Functionally, OIS consisted of:

* **Electronic Mail (EM)**: Creating, editing, reading, sending, answering, forwarding, and return receipt. Mailing lists and BITS outbound. Electronic filing and retrieval.

* **Word Processing (WP)**: Creating and editing.

* **Administrative Office Aids**: Spelling checker, file folder, waste basket, reports, and change password. Tickler, calendar, spreadsheet, graphics, datatrieve, autodialer, phone directory, and calculator.

* **Access to Other Systems**: BTShare, Cash Connector (transactions for each customer), Commercial Loan, Historical Research, WIS File Cabinet, TSO, Financial Asset Inventory System (FAIS), and Automated Competitor Intelligence System (ACIS).

Not all of these functions are currently implemented. [illegible] has enhanced All-in-One by adding various features including output queues, usage statistics, database reorganization, file folder features, guest privileges, and a pc option.

5.3. Implementation Schedule

Planning for OIS started in the spring of 1982. Equipment was installed in New York during the summer and the pre-pilot started with IMS. Equipment was installed in the field, beginning in November and lasting through the beginning of 1983. At that time pilot testing commenced.

The identification of goals and success criteria for the pilot occurred during the winter of 1983 and evaluation continued through 1983 and into the beginning of 1984. In June 1984, a decision was made to use a scaled back version of the system that emphasized EM and reduced cost for all of ID. During 1984, usage began to expand, unofficially, beyond ID, and this continued until 1985, when the system was expanded, officially, bank wide. There are some 200 users in Asia/Pacific now out of 800 users bank wide.

5.4. Cost

OIS cost about 1.6 million dollars, per year, without international telecommunications. This includes equipment, software development and support. When the system was scaled back in functionality (June 1984), costs were reduced to about 950K per year. With the expansion of OIS, bank wide, costs have risen to about 1.4 million per year[9]

6. How OIS is Used

OIS is used in different ways, in ID, by different types of employees, depending upon whether they are located in the field or in New York. Part of the philosophy behind the system is that *everyone* will prepare, send and receive their own messages.

In the field, OIS is used mostly for communications and for word processing. Officers read their mail first thing in the morning and prepare their own replies. They may check the system 3-4 times additionally during the day. When people from New York are traveling, they tend to use the system heavily from field locations. The reduced number of terminals overseas, however, limits access to the system and people have to wait often for a terminal. Speed of the lines and the need for certain of the Operations offices in New York to be open in order to use on-line files restricts the usefulness of the connection to the application systems. Many people don't know or have forgotten how to use features other than EM and WP.

Secretaries make extensive use of WP and EM. Larger documents are prepared off-line on DECMates, listed out for proofing, corrections are entered and then the documents are transmitted over OIS. The low speed lines and high transmission costs restrict use of the system interactively.

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[9] Currently, the average monthly cost per user is about $145, based on a base of 800 users.

In New York, almost everyone in Asia/Pacific has their own VDT terminal which, along with the higher speed lines, encourages use. People send and receive their own mail (there is considerably higher traffic rates in New York because of the greater connectivity and bandwidth) and also does much of their own document preparation. Officers and support staff make extensive use of connections to other systems, directly accessing the Commercial Loan, Cash Connector and Historical Research systems instead of contacting the respective operations offices on the phone. Secretaries have a VDT terminal next to their desks (along with their typewriter) and there are hooded draft and letter quality printers scattered about the offices, usually in the center of a room. Occasionally, two secretaries will share a terminal which will be placed mid-way between their desks.

An active officer in New York might be continuously logged in to the system, receiving 10-15 messages a day and transmitting 7-10. Meetings may take place around a terminal while someone pages through a document or a list on the screen. Some of the officers use OIS to gain access to BTShare where they execute an analytic procedure they have written and route the output back to the terminal or to a printer. A spread sheet function is used for preparing plans; it can be down loaded to a pc or work on a pc can up loaded into OIS.

A person is charged for the functions used. Basic OIS, which includes EM and WP, is billed at about $100 per month. Extended features, including advanced office aids and access other systems (BTShare, TSO, and the bank's operational systems) costs another $50, for a total of $150. A department decides what features of the system an employee is entitled to use and IMS charges the department accordingly.

7. What has Changed

7.1. Job Content and Skill Level

The content of secretaries jobs have clearly improved, in terms of the variety of the work and the level of skills required, although their grade level or relative compensation have not changed. It used to be that a secretary would send 40 TELEXs a day. This meant spending 2-3 hours in the TELEX room and many more hours in preparation. Now principals send most of their own messages. Because not all offices have OIS, some TELEXs still have to be sent, but this is much easier with OIS's ability to send outgoing TELEX messages. The message is drafted in OIS (often by the principal) and then sent out as a TELEX.

The secretaries typing load has been reduced, consisting mainly of larger manuscripts now. This has freed time for other activities: some customer contact, some research, and better service to their principals. The WP has permitted creating more "professional" looking work. Some secretaries feel also that the total amount of paper has decreased, especially with the Electronic Filing Cabinet. Many principals, however, still request hard copy from the system to take home, carry with them on trips, or just to put in their own files[10]. Many feel that the paper files have not decreased in size.

The secretaries are very positive about the system. They feel that they have acquired new skills and that they are more productive than before. There are fewer interruptions and they are better able to concentrate on their work. They feel more "in touch" with their principal's work and they actively seek to solve problems. As one secretary put it, "you don't have to wait for the paper to come to you, you just pull it up on the system." They are proud that management has seen fit to invest in better tools for them; it makes them feel important. Many have decorated or personalized their terminals and one of the secretaries sends messages over the system in the form of Christmas trees at holiday time.

Another way the system has benefited secretaries is by opening a new career path. One secretary, who showed an unusual interest in and skill with the system, was promoted to be the local system "expert" who provided consultation and teaching to others in the Asia/Pacific Group's New York headquarters[11]. She has transferred to TD and now mans the OIS *Help* desk, world wide, from her location in Asia/Pacific. This transfer did result in a positive grade and salary change and the incumbent believes that she has many more career options now than she had before. She likes her role because it permits her to meet and talk with many different people. It gives her an opportunity to teach something (rather than being taught).

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[10] It appears that certain people are much more willing than others to give up their hard copy records. Speculating, one might expect this to be a function of how secure an individual felt in his position and how easy it was for them to build a cognitive model of their work when they used the system.

Management appears not to have anticipated the change in work mix for the secretaries and there has been little direction as to how their role should evolve. Each secretary has been left on their own to work this out as best they can. In Tokyo, for example, one of the secretaries got heavily involved in administrative work, while in New York there has been relatively little change in the content of the secretaries job (with the exception of reduced TELEX preparation and transmission).

Some managers feel that the system helps them establish priorities in their work. For example, by looking at who sent messages and their subjects (using the "scan" function) the important messages can be selected first. Another manager believes he is better aware of "what is going on in Asia." There is more of a tendency now to inform people because it is a lot easier to send a carbon copy.

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[11] Part of the implementation strategy for the project was to have a `coordinator' at each location who would serve as a contact person and be available for special assistance to the remainder of the workers at the site. These were mostly officers, selected on the basis of their being the most qualified to do the job (and a willingness to serve in the role). They received no change in grade or salary, but did receive somewhat more detailed training.

7.2. Structural Arrangements

Although there have been no major changes in structure or social support, the system has facilitated social interaction among levels. Since the secretaries were the first trained on the system, they became the most knowledgable and experienced users. Then, the more junior officers began to use the system. Finally, the more senior officers, some of whom were quite skeptical at first, began to see direct benefits. By this time the easiest way for the senior officers to learn about the system was to be taught by juniors or secretaries. As a result, the system became a vehicle for interaction among the staff; it served to break down some of the barriers that exist, particularly in the field.

As shown in Table 7-1, TELEX outgoing messages decreased after OIS was installed. In the three months prior to OIS, BITS traffic for the Asia/Pacific group averaged 159 messages per day (with a s.d. of 7.6). In the same period a year later, BITS message traffic averaged 69 messages per day (s.d.= 4.9), a decrease of 57%. Prior to this, BITS traffic for the group had been growing at about 10% a year. This suggests that part of OIS traffic substituted for BITS.

Table 7-1: Asia/Pacific Group Daily Message Traffic

Month		BITS	X	s.d.	OIS
1982	Sep	168			--
	Oct	152	159	7.5	--
	Nov	158			--
	Dec	135			48
1983	Jan	153			98
	Feb	125			99
	Mar	120			98
	Apr	101			98
	May	106			83
	Jun	102			77
	Jul	70			63
	Aug	73			102
	Sep	71			123
	Oct	66	69	4.9	102
	Nov	60			133

Note: BITS outgoing messages have been adjusted by a factor of 1.4 to make them comparable to the way OIS messages are counted.

7.3. Communication

Principals believe that the system has cut down on the number of telephone calls and distributed memos, especially in New York. Messages on the system tend to be brief; frequently one or two screens. People feel more productive. They try one phone call (probably because it is faster than typing the message and they don't have to interrupt what they are doing to sign-on to the system) and, if they aren't able to get their party, they send a message over the system knowing it will be read by the end of the day. The new tool provides them with alternatives that permit accomplishing sub-goals. Some reports are distributed over the system instead of being sent around as hard copy ("you don't have to use the `pouch' as much now"). For example, the Monthly Profitability System (MPS) used in planning took several days to distribute. Now it is loaded into OIS and delivered by EM. Most people agree that more information is available now and it is easier to obtain than before OIS. Part of this undoubtedly results from the ease of sending copies over OIS Some analyses are prepared on a Rainbow or IBM pc and then up-loaded into OIS for distribution.

Several people observed that the English of employees, where English was not their native tongue, improved after they began creating and reading their own messages using OIS.

The amount of trivial messages have also increased, however, and much of the communication is between officers on the same level, for example, among junior officers, rather than among levels that would enhance information flow up and down the hierarchy. And, for certain people, the system has served as an excuse not to get get out in the field to find out what is really going on, or to meet with customers. As one officer said, "it is easy to become mesmerized by the screen." There is concern on the part of some operatives that management will see everything "through the machine" and will not get out in the field to make their presence felt.

Another put the concern about content this way, "when you are out of the office a lot of messages build up and that is when you can really see the trivia. So many people send messages I don't need to see." Some officers feel that the system has contributed to their "overload." Another observed that there is a tendency to "bullshit" and that the truth is usually a little less than appears on the screen.

Several principals noted that there is a tendency to be more "casual" on the system. People say things on the system they might not put in a memo. They are more relaxed and may interject a few jokes or put in samples of conversation with a customer. Memos, at Bankers Trust, seem to be more formal than in many other organizations; they are associated with reports.

Several managers felt that the return receipt feature is useful because it becomes harder for people to say they didn't receive a document.

Almost everyone agreed that in times of great pressure or emergency, people revert to their old methods of doing work. They tend to pick up the phone and they may not read their EM for several days. It becomes a "pain" to log in and people get up so they can "physically" do something. With urgent items there appears to be comfort in having "paper copy."

7.4. Work Location

As a result of the system some work has shifted to the field with resulting efficiencies. It used to be that everything was sent to New York for entry into the bank's operational systems. Now some of the data entry is done from the field offices. The reduction in transmittal time makes these systems more current, the error detection/correction cycle is shortened and the work does not "bunch up" in New York as it did before. Also, source documents do not have to be transported and it reduces copying.

Other, more subtle, changes have taken place. In the past, an officer from the field would call the New York CSO who would work with Operations, downtown, to resolve the problem and then communicate with the field. Now. people in the field work directly with Operations and there is less of a need for the CSOs.

There appear to have been few changes in where the "big" things are handled. The field still makes all of the deals and key decisions; approvals come from New York.

7.5. Supervision and Performance Measures

Supervisors say they feel more comfortable moving people because the system is a common element in all of the Asia/Pacific offices. The system has resulted in some standardization (of equipment and procedures) making staff more interchangeable. Some workers believe that the system contributes positively to supervision because it is easier to communicate with their supervisor and to keep them informed of what they are doing by sending copies of their work. People appear to be positive about having their work more "visible" to a supervisor. Possibly, this is because some workers are located remotely from their supervisors and believe that they don't really know what they are doing. The supervisors do not believe that the system has made it easier to supervise, except that they do feel better informed about what is going on in the bank.

7.6. Power

In some respects the system has raised the importance of the secretaries, due to their familiarity with it. As the system became an accepted "tool" serving a recognized, useful purpose, those people most knowledgable about it were swept along into more prominent roles. Whether this is lasting or not remains to be shown. To the extent association with the system, in this environment, is viewed as improving one's stature as a banker, the effect should be positive. If the system is perceived as a technological "toy", then association could be detrimental. It is not clear that the "key" players have moved forward as a result of their role in advocating the system and in its implementation.

7.7. Employment Levels

The number of secretaries has decreased, for example, from 11 in the New York office to 7 now. There have been smaller reductions in the field. Principals now believe they need less secretarial support, partially because the secretary to principal ratio has decreased. There have been no employment changes at the CSO, principal, or management levels in Asia/Pacific as a result of the system. Several new positions have been created in IMS to support the system and to staff the `help' function.

7.8. Performance and Cost

Although it is difficult to quantify, the feeling is that there has been an increase in individual productivity and more communication with customers. The bank's competitiveness has increased. A one day turn-around on approvals for certain proposals has made the bank more responsive to their customers.

As one officer put it, "we're definitely going in the right direction on the bottom line." Communications has really improved within the bank and there is more "connectivity." Another said, "it is worth the effort and the cost in ease and efficiency."

Another manager pointed out that the system permits him more time flexibility. He can now do work from his home or hotel room and he doesn't have to spend as much time on the telephone. It is now possible to send others the outline of a report and then converse with them over the details. Documents can be exchanged back and forth between Hong Kong and New York with each person editing and adding to them. This is done quite frequently.

OIS has not had as much of an effect as was anticipated on either quantifiable performance measures or the "bottom line." Application systems were not sufficiently accessible from the field to permit an assessment of labor or cost savings in restructuring work flow. "Relationship" management[12], as a concept, never caught on, largely because it required forms to be filled out and "core" reports to be filed by field personnel. While OIS would have made controlling and maintaining this data easier than manual methods, not going forward with the relationship management idea removed one of the reasons for the "extended function" portion of the system.

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[12] Relationship management was a strategy to improve the data the bank had on key clients. Its goal was to permit some forward planning on the relationship with clients, rather than to have these come about by chance.

While the time to complete a loan proposal was reduced this did not necessarily contribute to making more or better loans. Marketing personnel have not reduced the time they spend on administrative matters and CSOs still handle most of the contact with the field. While the *potential* to alter these relations has been shown, the implications have not been fully evaluated or changes institutionalized.

The head of Asia/Pacific attributes some portion of the improvement in performance of his division between 1984 and the prior year (a 35% increase in revenue and a 60% increase in after tax income) to OIS, but it is difficult to apportion the amount. Most of the contribution appears to have been in improved communication and coordination among departments.

OIS is a sophisticated system that will not be fully cost justified on EM alone, unless the complete bank is served. Other features, particularly access to application systems, must also be used. This implies fundamental changes to work processes, operational procedures and systems. This will take considerable additional investment of time and money.

8. Implementation of OIS

For the implementation of OIS, IMS hired a person, who had experience in bringing up a similar system for another financial institution, to play a key role in the project. They also retained a consultant well known in Office Systems to assist them in identifying potential problems and to aid in planning the implementation. The two stage pilot test, first with IMS itself and then with Asia/Pacific, gave them ample opportunity to debug the communications equipment, software and to configure the system. In a way, this approach could be considered a form of `prototyping.'

A well respected member of Asia/Pacific, who had been involved in the initial feasibility study, was selected as the user representative on the implementation team. He devoted full time to the project during the pilot phase.

The original concept was that four officers would share a terminal in the field. This didn't work well and the feeling now is that a terminal should be placed in each office. Another part of the concept was that there would be one-on-one training, behind closed doors, to facilitate learning without embarrassing the person involved. One of the tactics used by IMS in implementing OIS was to designate an on-site person as the resident OIS "expert" in each office. This person received special training and became a "friendly" source of information for the remainder of the area.

While there was some "cultural" resistance to the system in the field, at the more senior levels, this was only in the short run and disappeared as soon as it became apparent the "boss" was using the system. The Japanese and Koreans were most resistant, while the Chinese took to it easily. As one officer put it, "it helped if you could type." The culture in New York was never a problem. As one senior executive said, "bank culture was that `real' men don't type. In this situation, the power of technology overcame the culture of the bank."

Special care was taken to have documentation prepared and to provide training sessions on the equipment. While this was effective in getting people to learn the system and overcoming apprehension, some, especially after they had experience using the system, felt it was "overkill" by the people in New York. The staging of people using the system (transfers, not being selected for the first part of the pilot, initial skepticism, etc.) meant that a good portion of the staff were trained by their colleagues, rather than in the formal sessions. The simplicity of the system and its self-help features made it easy for many of the staff to learn on their own.

The system has been quite stable and available. One weekend a number of messages were lost, but outside of this the system has performed well. If trouble does arise, the local experts are notified and they go around to the remainder of the staff to let them know what is happening. The main system is heavily loaded now and people are beginning to complain about the slow response time.

The difficulties experienced have been with the telecommunications portion of the system, particularly overseas. There have been problems getting lines in Japan and with the Telecommunications Authority in Singapore, where the parameters of the system were changed without notification. A direct line from Korea to New York was put in and that improved things. Some of the difficulties were "jurisdictional" within the company, particularly between the project and the Communications Department.

8.1. Expectations

Many managers think the system is "great." Their expectations were predicated on their prior experience. The system was sold to Asia/Pacific as having a large number of features and since electronic computers operate "at the speed of light" their expectations were high. In practice, in the field, it operated more slowly than they expected (largely because of communications difficulties). This affected the attractiveness of some of the features, for example, connections to the application systems.

Some other managers did not have positive expectations for the system initially. The value of the system did not become apparent to them for 6 months. At first, they used the system through intermediaries, but this proved much less efficient than when they used it themselves and this practice has disappeared. These managers are generally satisfied now.

8.2. Reasons for Outcomes

One of the major reasons for the implementation success was top management support. The heads of ID and the head of Asia/Pacific used the system. As one middle level manager put it, "when you called (the head of ID) his secretary would say, 'I'll have him call you back.' But he was too busy. If you wanted to get a message to him, you had to send it over the system. At least I knew he would read it by the end of the day."

Another manager observed, "Those people who use it frequently have lots good to say for the machine; infrequent users are generally against it."

8.3. Suggestions for Improvement

Most people feel it would be extremely helpful if incoming TELEXs could be received through the system. Then they would be dealing with one device for all of their written communication.

One of the most important benefits of the system is access to the various application systems, for example the Historical Record of Money Transfers, Commercial Loans or Collections. People at the operational level, particularly, believe these should be expanded and approached in a serious manner if the bank is to gain some of the *real* benefits from office technology - those that occur from changes in the allocation of tasks among workers and in the location of where tasks are performed.

Use of leased lines and satellite communications could increase bandwidth and make the system much more usable in the field. This would also decrease the primary source of errors. Improvements in performance overseas could be obtained if there were local processors (VAX/11-725s or microVAXs) in major regions, for example, London and Tokyo. This would reduce traffic on the relatively slow transoceanic links. It would also be beneficial to upgrade the capacity and reliability of all of the telecommunications links outside of the U.S., especially those that rely on Telenet. Of course, considerable additional investment would be required.

The secretaries observe that the printers are noisy and disturbing. Most locations have some form of sound suppression enclosure for the printers. Several people were knowledgable enough to observe that in future configurations, consideration should be given to laser/xerographic or ink jet technology printers.

One officer noted that it would be useful to search files for a character string (full text search), rather than just strings in the "subject" field.

9. Interpretation of Events

This study is consistent with Laudon's [Laudon 85] model of implementation and Bikson's [Bikson 81] set of situational characteristics that influence innovation. The original reasons for deciding to implement the system were environmental; the desire to improve world-wide communications in ID and to put together more competitive deals. The factors that governed the success or failure of the implementation were institutional. Probably the most important was the visible and unwavering support of top management, at least through out the pilot. Key actors were involved from the beginning and provided their backing. They also manipulated incentives by making it easier for their staffs to communicate with them over the system than by other means and making it clear that everyone was to enter and receive their own messages.

Another contributing factor was the involvement of users in the feasibility study and in the actual implementation. Having a respected and dedicated officer from ID control the implementation project resulted in the surfacing of real needs and proper weight being given to them during design.

These factors alone, while critical, are not sufficient to guarantee success. If unwise technical decisions are made or decisions based upon inaccurate technical information, then the implementation is likely to be compromised. The careful technical planning, the scope of the system and its integration, the open-ended nature of the architecture that permitted the addition and deletion of applications and features, and the choice of a reliable mini-computer with a variety of options for distributed processing all contributed to the successful pilot.

Environments, however, have a tendency to be dynamic. Changing times and markets resulted in shifts in ID's business. Instead of stressing lending and deposit taking, more emphases is being given to non-credit services and intermediary roles. Just how OIS fits in with these new endeavors is not clear. This has resulted in re-thinking the scope of the system.

10. Policy Issues Raised by the Study

This study raises a number of questions concerning organizational policy with regard to office automation.

10.1. Issues

One major issue raised by OIS is planning for the evolution of jobs when there is likely to be significant change or replacement. Thought should be given, in advance, as to how these jobs should change, for example, identifying new tasks to be assumed, providing adequate training and supervision rather than allowing this to unfold based on the pragmatics of the situation.

Another issue is what becomes of those secretaries that are displaced through improvements in productivity. If the number is small then decreasing staff size through attrition is probably sufficient. If a larger number were involved, then, some formal program of retraining and absorption elsewhere in the company, or dismissal would have to be initiated.

Another issue concerns the company's policy towards work at home. OIS allows one to work remotely, by taking a portable terminal home or to a hotel room when traveling. This raises questions about the need to actually be in the office at all and, at the other extreme, the possibly of exploitation. Will those workers that choose not to work at home be penalized? There is no indication that, either these issues were considered or, that there was pressure to work, after hours, without compensation.

Security is a potential issue. Although most users were not concerned about privacy or security violations, pointing out that they currently use open TELEXs and telephones and that OIS is certainly more secure than these, IMS is aware of the potential for abuse. Care (and the auditors) dictated that none of the operational files could be updated from the field. But the potential for accessing confidential information remains.

There are also questions of technology transfer. If one configures an office system in the U.S. with the latest technology, how much of this can be taken abroad? Then, the interference of the Telecommunications Authority in Singapore was a concern. Trans-border data flow became an issue in Taiwan and it is the reason the system is not installed there. Local regulations prohibit the transfer of financial data out of the country. The project team was told that the government would require an armed soldier standing next to the terminal when it was in use.

Finally, it is not clear what group, at BT, looks at the information needs of the *whole* bank. TD tracks the technology, develops application systems as targets of opportunity and does some bank-wide information system architectural planning, although this latter activity is mostly for the purpose of coordinating systems rather than assessing executives information needs.

10.2. Paradoxes

The current status of OIS is, to a certain extent, in equilibrium. The pilot has been clearly a success. Communication in the Asia/Pacific group has improved greatly. There is strong user acceptance in the field and in New York. Technically and functionally, the system works well. Yet, some of the bottom line benefits that were anticipated, for example, in closing more deals, have not been achieved. The system was "streamlined" after completion of the pilot, as an expense savings, by reducing functionality so it could accommodate more users on EM, for example, by cutting back on some of the administrative office aids and the access to application systems, and by reducing the support staff, and then adopted by ID.

The real payoffs may well come from having the system widely used in the bank, so that it serves as a *single* interface to all written material, and this has not occurred. Communications, especially overseas has been a problem, which limits the usefulness of the system. At certain times the system is heavily loaded which affects performance and user satisfaction. It is costly to run and separate pricing of services encourages discontinuing those that become non-profitable, shrinking the coverage and making the system less attractive.

The integration of the bank's applications into OIS has been somewhat half-hearted. In one case the interface to an Operations area has been via a terminal located in the corner of an office rather than into the main intake stream. If the terminal operator happens to be out that day, messages may not be read and and the work requested is not performed. Thus, if an answer does not come back in a reasonable amount of time, a follow-up phone call is made, although this defeats the purpose of the system. In another case, the application is only available during working hours in New York (because files are being updated by a batch system at other times). This limits greatly the usefulness of the particular application in the field. Sometimes support for an application is withdrawn without a lot of notice (for example, access to the "downtown" reports on-line) and people are back to contacting the Operations area directly. This confuses them and reduces their incentive to learn how to use these interfaces and systems.

The difficulty appears to be that each interface costs money and there has to be strong support and funding from the user community before the systems work, programming and procedural changes can be made to create a truly integrated operation. This is a good example of how the bank's overall strategy of controlling non-interest operating expenses and internal expense budgeting operate to their disadvantage. By not funding the infra-structure directly, the bank has not positioned itself to take advantage of office technology in improving operations.

An argument could be made that, for a bank stressing "origination" and "distribution", i.e., investment banking, the main benefits of OIS are instantaneous communication world-wide, and in this the system has been extremely successful. This constrained view of OIS, however, seems shortsighted, as it does not explore the potential offered by the technology for improving operational efficiencies (by reducing non-interest or non-risk expenses), or for gaining a competitive edge, by, for example, allowing direct communication with clients. It is not that the bank should use technology for its own sake, but, rather, that the bank is acting inconsistently by not being as aggressive in this area as they are in marketing their services.

While the feasibility of OIS has been shown by the pilot, the project was in a state of limbo from June 1983 to June 1984, at which time it was adopted for all of ID, but with reduced functionality and cost (compared with the pilot in Asia/Pacific). During this period there was considerable soul searching by management, as to whether to go for the full system or one with reduced functionality, stressing EM. Several large transaction processing systems were in difficulty at this time (cost over-run and schedule slippage) compromising the credibility of CSD and IMS. In addition, the head of ID was unwilling to risk the visibility and organizational upheaval associated with the full-function system.

There are those who felt this was the wrong decision. That the system shouldn't have been cut back at this point when real benefits were just beginning to be achieved. As one person put it, "we are in the *dark ages* in our use of technology compared to other commercial banks and financial institutions. The *real* conflict is between the young turks, the high flyers and the bankers, between uptown and downtown, between the front and the back office."

The costs to gain benefits beyond those of improved communication are substantial. It implys a commitment to use the system, bank wide, as the primary vehicle for written communication and information flow. This involves considerable expenditures for equipment and support, and overcoming resistance in many areas of the bank. It means confronting the conflict between the flyers and bankers and breaking down the barrier between the front and back offices. This level of commitment is a difficult step for a company that has been successful by carefully controlling expenses and by not taking unnecessary risks.

Technology is only one component of a business strategy. ID is facing a different environment and performing different activities now, than they were in June 1982, when the pilot started. While the potential of OIS may not have been explored, fully, in terms of changes to the content and location of work, organizational structure and bottom-line outcomes, executive management is in agreement that they couldn't do what they are doing today without OIS, unless they hired a lot more people. In this regard, the system has clearly been a success.

10.3. Postscript

Since the time the study was performed, BT has decided to offer OIS bank-wide. The responsibility for the system was shifted from IMS to a newly formed group, Corporate Information/Communication Unit, run from London. The number of users on the system has increased and is currently (June 1985) close to 800. Modifications to the bank's application systems to support access by OIS have been made slowly, but steadily, so that many can now be accessed around the clock. OIS is now accepted as the bank's primary office system.

Significantly, the executive management of Asia/Pacific is moving from New York to Hong Kong, a move consistent with the bank's philosophy that businesses should be managed locally. OIS has definitely contributed to achieving this business goal. It is a tribute to OIS that the top people in Asia/Pacific feel comfortable enough communicating with *their* management over the system that they are willing to leave New York and the proximity to power.

11. Comparisons with Prior Research

The results of this study are reasonably consistent with those found by other researchers. Hammer's [Hammer 85] investigation of CitiMail at CitiBank found, similar to this study, that the ability to communicate across time zones by sending messages out in the afternoon and finding replies waiting in the morning was the primary reason for adoption of the system. Address lists were constructed of people within CitiBank dealing with a particular client and then used to communicate internal information pertaining to that client. Thus, CitiMail facilitated communication that cut across organizational and geographic boundaries. While the initial motivation for starting the system was improved international communication, as the system matured, the pattern shifted to emphasize local communication.

Support by senior management was also instrumental in staff acceptance of the system. Considerable resistance to changing established communications patterns was encountered. In order to provide incentives, executive management at CitiBank went so far as to use the system to announce key information and important organizational changes several hours before some of the material was released to the press or made public. They believe that the system had an important cultural benefit in exposing many staff to computer use, thus reducing their resistance to electronic banking. Unexpectedly, considerable resistance was found to the use of the 'return receipt' feature. Some staff refused to read messages marked with return receipt (they deleted them without reading) because they felt this was an invasion of their privacy.

Hammer found that users tended, on the average, to log on to the system twice a day and that a session lasted about 15 minutes. An average of seven messages were sent per day and ten messages received[13]. This represented more communication than was received by memo, but less than by telephone. Hammer observed that messages tended to be limited to one screen with an average length of 8 lines (for a sample of 500 messages) and that they contained one or two simple ideas. He also noted that the messages were less formal than written memos and that the sender's personality was often evident. Contrary to the OIS study, Hammer did not find substantial substitution of EM for either TELEX or telephone traffic, although there was some reduction in the rate of their growth.

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[13] This ratio of 1.4 messages received to messages sent was also found in the BT OIS and BITS traffic suggesting that it may be a constant factor.

Mountgomery et al. [Mountgomery 83] suggest that time zone problems and difficulties in coordination may lead companies to experiment with computer based message systems, although this study did not consider specifically the TELEX problem. Time zone and communications difficulties were two of the main reasons for initiation of the OIS pilot in ID.

Crawford [Crawford 82] found that a pilot group's reaction to EM to be "almost universally favorable." He noted that users were impressed by the speed and efficiency of non-simultaneous communication, and its effectiveness in "broadcasting" information to a number of people at the same time. He observed that managers felt they were able to accomplish tasks they could not otherwise have done, particularly in information exchange and distribution. Similar findings occurred in this study.

This study did not find clerical workers with a more specialized and centralized job, as suggested by Olson [Olson 82]. To the contrary, clerical workers appeared to have acquired new tasks with more variety and higher level skills than before. Not only was much unnecessary work eliminated, but some of the routine work (for example, typing) was transferred to others.

Poppel [Poppel 82] predicts that the use of Office Automation technology will have considerable impact on the tasks that managers perform and their bottom line performance. The findings of this study suggest that these effects may be considerably less than suspected. Although the form of tasks changed, their content really didn't, nor was there a strong bottom line influence.

12. Conclusion

A current theme is that of the `technological imperative' - firms adopt the technology and all sorts of `good' changes will follow. This study demonstrates the contingent nature and complexity of innovation in organizations. In this case, a clear business need, top management support, a good technological solution, a successful pilot and the best intentions of all parties still did not result in changing things significantly. Part of the reason was the clash of objectives among the different players. Part is the difficulty of translating goals into programs. Part is the inertia of large organizations where the energy behind an idea eventually becomes dissipated and the idea languishes. Part is a lack of understanding (or an unwillingness to understand) the factors underlying business success.

This study suggest that one must be cautious in predicting the consequences technology will have for workers. There are many possibilities and one is tempted, based on individual values and the potential inherent in a technology, to sketch an enormously broad contour in almost any direction. The trajectory actually taken, however, is influenced by business objectives, economics and the situational factors that compose an implementation. Consequently, it is likely to fall far short of what is possible. People and their organizations are just terribly hard to change.

I. I

Interview Protocol

I.1. Goals

The interviews are intended to reveal information about:

- *Job Content*: The tasks a person performs in the course of a normal day. The responsibilities a person has. The authority a person has. The extent a person has control over the choice of work methods and pacing. The pressure and work load of the job.
- *Structural Arrangements*: Formal organizational structure. Who one works with. Who one gains assistance from and the ease of obtaining it. Who one communicates with in OIS.
- *Power*: Recent shifts in power.
- *Skill*: Changes in skill level. Recent education or training programs.
- *Performance*: Performance metrics for major work products. Productivity. Quality of work products. New products. Competition. Industry position.
- *Attitudes about OIS*: Likes and dislikes. Functional adequacy. Improvements or changes. Attitudes about technology.
- *Implementation*: Opinions about the implementation process. Role played in implementation. Reasons for success or failure.

I.2. Questions

1. What is your ~~job~~ at the bank?
2. When did you begin using OIS?
3. What do you use OIS for?
4. About how much time do you spend using OIS in a typical day?
5. What role, if any, did you play in the implementation of OIS?

6. What do you like best about OIS?
7. What do you like least about OIS?
8. Has OIS met your expectations?
9. Were you trained in OIS?
10. What do you do when you encounter problems in your job?
11. What do you do when you encounter problems with OIS?
12. What types of problems do you encounter with OIS?
13. What would you change about OIS?
14. Should OIS be used elsewhere in the bank?
15. Is OIS worth it? (in terms of the cost and the effort to use it.)
16. Are you concerned about the security of OIS?
17. How has your job changed over the last several years? (what you do and how you do it.)
18. How has the work of your colleagues changed?
19. Have there been any shifts in the number of workers in your group?
20. What shifts, if any, have taken place in where things are done, especially between the field and the home office?
21. Has your access to information or the amount of time required to obtained information been altered?
22. Has the number of reports or computer output you receive changed?
23. How is your performance measured?
24. Have there been any changes in the the number or quality of the products you produce?
25. Has there been any change in the amount of control over the way you do your job?
26. Has there been any change in your work load?

II. II

Glossary

ACIS - Automated Competitor Intelligence System
BITS - Bankers Trust International TELEX System
BT - Bankers Trust Company
BTAL - Bankers Trust subsidiary located in Australia
BTNet - Bankers Trust private telecommunications network
BTShare - Bankers Trust internal timesharing system
CSD - Computer Systems Department
CSO - Customer Service Officer
DEC - Digital Equipment Corporation
DECNET - Telecommunications software for DEC computers
EM - Electronic Mail
FAIS - Financial Asset Inventory System
HR - Historical Research System
ID - International Department
IMS - Information Management Services
IRMD - International Risk Management and Credit Review
MPS - Monthly Profitability System
OIS - Office Information System
ROE - Return on average common equity
TD - Technology Department
TISCO - Bankers Trust subsidiary located in Bangkok
TSO - IBM time shared operating system
VAX - DEC computer
VDT - Video display terminal
VMS - DEC operating system for VAX computers
WP - Word processing

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